

DOCUMENT RESUME

ED 265 368

CE 043 340

TITLE The Use of Hand Tools in Agricultural Mechanics.
INSTITUTION Montana State Univ., Bozeman. Dept. of Agricultural and Industrial Education.
SPONS AGENCY Montana State Office of Public Instruction, Helena. Dept. of Vocational Education Services.
PUB DATE Jul 85
NOTE 131p.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS *Agricultural Education; *Agricultural Engineering; Behavioral Objectives; *Classroom Techniques; Course Content; Course Organization; Equipment; *Hand Tools; Learning Activities; Lesson Plans; Safety; Secondary Education; *Teaching Methods; Transparencies; Units of Study; Vocational Education

IDENTIFIERS Montana

ABSTRACT

This document contains a unit for teaching the use of hand tools in agricultural mechanics in Montana. It consists of an outline of the unit and seven lesson plans. The unit outline contains the following components: situation, aims and goals, list of lessons, student activities, teacher activities, special equipment needed, and references. The seven lessons cover these topics: hand tools; hacksaws, files, and whetstones; power grinding; sharpening plane irons and wood chisels, knives, axes and hatchets, metal chisels, punches, twist drills, auger bits, and tin snips and scissors; distinguishing between crosscut saws and rip saws; taking care of hand tools; and using a chain saw safely. Each lesson contains some or all of the following parts: estimated time, why the lesson is needed, objectives, interest approach, presentation, tryout experience, follow-up, equipment needed, references, information sheets, and transparency masters or handouts. (KC)

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MT 85/3304

USE OF HAND TOOLS IN AGRICULTURAL MECHANICS

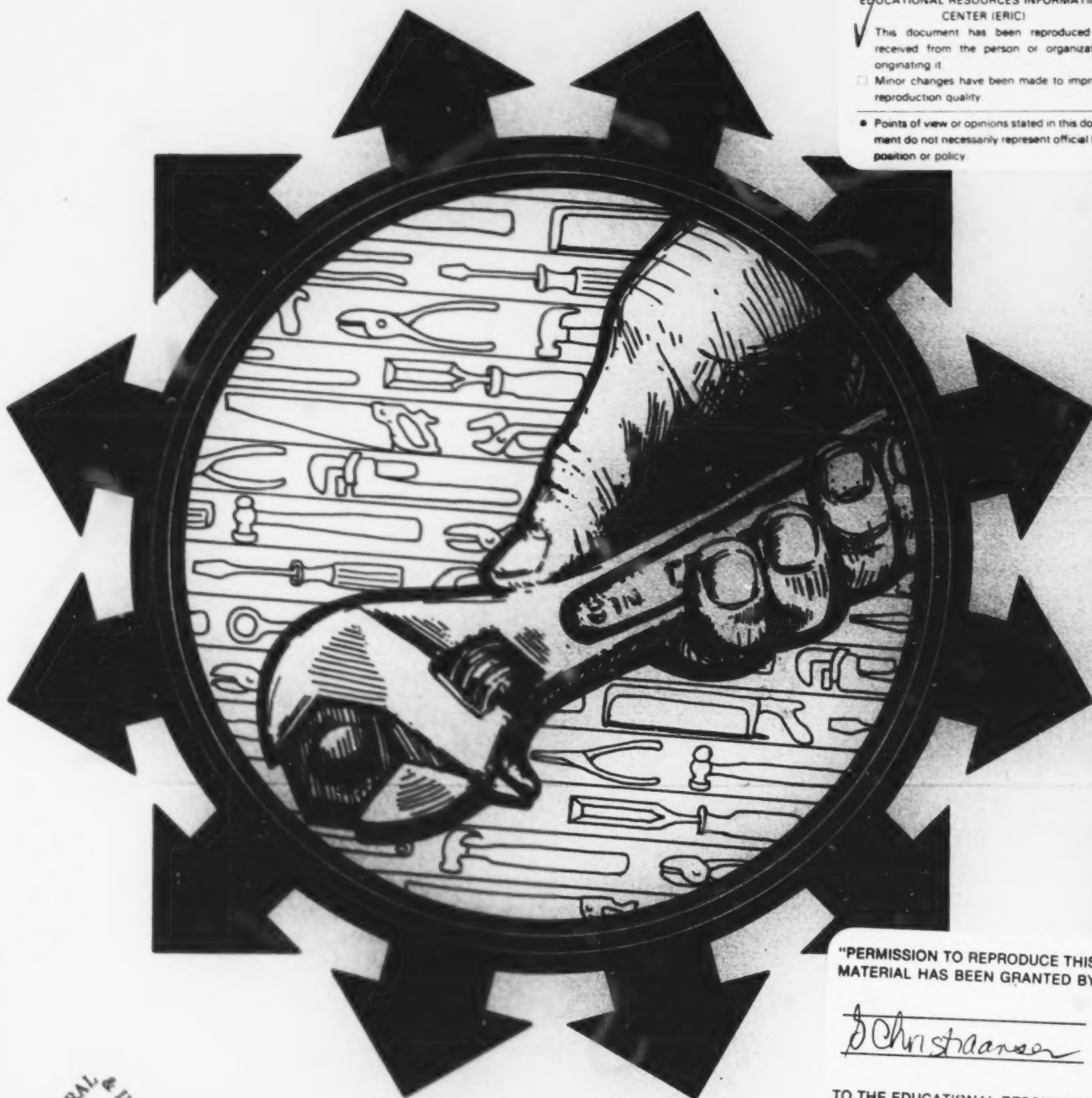
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THE USE OF HAND TOOLS IN
AGRICULTURAL MECHANICS

The work presented herein was supported
by the Office of Public Instruction
Department of Vocational Education
Services

Montana State University
Department of Agricultural & Industrial Education
Room 126, Cheever Hall, Bozeman, Montana
July, 1985

TABLE OF CONTENTS

<u>Lesson</u>	<u>Page</u>
What Tools Do You Know?	1
Hacksaws, Files and Whetstones	15
Can You Use a Power Grinder Safely?	27
How Do You Sharpen:	36
a. Plane Irons & Wood Chisels.	37
b. Knives	39
c. Axes and Hatchets	42
d. Metal Chisels	43
e. Punches	46
f. Twist Drills	48
g. Auger Bits	53
h. Tin Snips and Scissors	56
What is the Difference between a Crosscut Saw and a Rip Saw?	80
How Do You Take Care of Hand Tools?	93
Can You Use a Chain Saw Safely?	104

Forward

This unit of instruction has been designed especially for use with freshman vocational agriculture students. For your convenience, the material has been prepared to fit into a three-ring, loose-leaf notebook. Other material that is prepared to accompany this unit of instruction will be prepared in a similar manner.

The instructor should study the entire unit carefully before attempting to teach any of the lessons. The key concepts that should be presented to meet the objectives of the Montana Core curriculum are included; however, all material that would be applicable may not be provided. Each instructor should look for ways to include local examples where possible and appropriate.

Some handouts and visual materials are included with each lesson. Here again, each teacher may have additional illustrative material that would be appropriate. It is also important that all references listed at the end of each lesson be available for student use. The lesson content is based on the references listed. There are a number of overheads in the instructional unit entitled, "Basic Carpentry and Construction in Agriculture Mechanics" that may be useful with this unit.

Special thanks is given to Mr. Jay Westermarck, student, Department of Agricultural and Industrial Education, Bozeman, Montana who prepared the material included in this unit of instruction.

UNIT PLAN

Course: VO AG I

Unit: THE USE OF HAND TOOLS IN AGRICULTURAL MECHANICS

Situation:

Basic competencies in the care and use of common hand tools are essential in production agriculture and many agriculturally related fields. This unit offers the opportunity for students to gain skills in the care and use of hand tools. It also provides the opportunity for students to develop safe work habits and positive, constructive work attitudes.

This unit can serve as the base upon which other units in agricultural mechanics can be built. Since this is the first "in the shop" experience for many students, the skills, attitudes, and experiences gained may well have a very long lasting importance.

Aims and Goals:

1. To help students develop safe work habits in the shop.
2. To teach the students to identify various hand tools used in agricultural mechanics.
3. To teach students how to sharpen and maintain common hand tools used in agricultural mechanics.
4. To teach students the proper use of hand tools not covered in the Basic Carpentry and Construction in Agricultural Mechanics unit (1984 revision).
5. To teach students to clean and store tools properly.
6. To teach students to fit hammer handles.
7. To teach students to select saw blades for various operations.
8. To teach students to choose, install and use metal hacksaw blades.
9. To teach students to select sandpaper and sanding belts according to grit.
10. To teach students to select grinding wheels of various grades and grains.

11. To teach students to safely use and maintain a power grinder.
12. To teach students to maintain and sharpen a chainsaw.
13. (Optional) To teach students to use a chainsaw correctly

Lessons:

1. What Tools Do You Know?
2. Hacksaws, Files and Whetstones
3. Can You Use a Power Grinder Safely?
4. How Do You Sharpen:
 - a. Plane Irons and Wood Chisels?
 - b. Knives?
 - c. Axes and Hatchets?
 - d. Metal Chisels?
 - e. Punches?
 - f. Twist Drills?
 - g. Auger Bits?
 - h. Tin Snips and Scissors?
5. What is the Difference between a Crosscut Saw and a Rip Saw?
6. How Do You Take Care of Hand Tools?
7. Can You Use a Chain Saw Safely?

Student Activities:

1. Each student will identify and explain the use of selected common hand tools.
2. Each student will sharpen selected common hand tools.
3. Each student will pass a grinder safety test.
4. Each student will demonstrate selected skills in tool care and maintenance.
5. Each student will sharpen a chain saw.
6. Each student will perform maintenance procedures on a chain saw.
7. (Optional) Each student will demonstrate safe chain saw operating techniques.

Teacher Activities:

1. Gather examples of hand tools to be discussed.
2. Gather as many tools to sharpen as possible.
3. Design small projects to use if enough tools to sharpen cannot be found.
4. Order material for tool sharpening projects.
5. Maintain current references needed for the unit of instruction.
6. Prepare overheads and handouts as required.
7. Obtain samples of sandpaper in various grits.
8. Prepare a grinder safety test.
9. Prepare shop safety and cleanup rules.
10. Prepare a tool identification list for the students.
11. Prepare a chain saw safety test if applicable.

Special Equipment:

1. Safety glasses/face shields
2. Grinders, grinding wheels
3. Grinding wheel dressers
4. Whetstones
5. Sharpening tools:
 - a. Saw Set
 - b. Tool Gauge
 - c. Special Files
6. Handles, heads, and wedges for hammer handle fitting
7. Tools for sharpening
8. Material for projects if required
9. Chain saws and chain saw sharpening tools

References:

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The New American Machinist's Handbook, McGraw-Hill Book Company, Inc., 1955.

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Fundamentals of Service-Shop Tools, John Deere Service Publications, 1973.

Phipps, Lloyd J., Mechanics in Agriculture, The Interstate Printers and Publishers, Inc., 1977.

Jones, Mack M., Shopwork on the Farm, McGraw-Hill Book Company, Inc., 1955.

Wakeman, T.J., and McCoy, Vernon Lee, The Farm Shop, The MacMillan Company, 1960.

Wagner, Willis H., Modern Carpentry, The Goodheart-Willcox Co., Inc., 1979.

Resource Unit on Tool Use, Conditioning, Materials, and Products for Core Curriculum, Agricultural and Industrial Education, Montana State University, 1976.

Basic Carpentry and Construction in Agricultural Mechanics, Agricultural and Industrial Education, Montana State University, 1984.

"Safe Cutting with Your Chain Saw", (cassette tape), Beaird Poulan Division of Emerson Electric Company.

Chain Saw Safety Manual, Andreas Still, Postfach 1760, D-7050 Waiblingen.

Sarna, R.P., Chain Saw Manual, The Interstate, Danville, Illinois, 61832.

Chain Saw Safety, Gallatin National Forest, U.S. Department of Agriculture.

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 1: What Tools Do You Know?

Estimated Time Required:

Two or three periods depending upon which tools are covered and how much discussion takes place.

Need:

Beginning students in agricultural mechanics need to develop an understanding of what is expected of them in the shop. They need to develop safe work practices and enthusiastic work attitudes. Students also need to develop a basic knowledge of hand tool use and identification. It is important that these attitudes and skills be developed early in the student's career so they can serve as a basis for further mechanics skills. Students need to learn how to be safe, effective workers. Knowledge gained in this lesson may also prove helpful in FFA contests or for meeting requirements of FFA degrees.

This lesson is written on the assumption that it is the student's first exposure to the shop. Teachers may want to adapt it to their own circumstances.

Objectives:

Upon completion of this lesson, students should be able to:

1. Identify and explain the use of the given hand tools.
2. Demonstrate understanding of shop safety practices and shop conduct requirements.
3. Demonstrate proper techniques and safety procedures when using hand tools.
4. Demonstrate and understanding of shop clean-up procedures.

NOTE: Shop cleanup procedures and general shop safety practices are at the discretion of the instructor and will not be covered in detail in this unit. A partial list of shop safety rules and a sample clean-up schedule are included as references.

Interest Approach:

The motivation for this lesson could be that this is the first time in the shop for these students. A short discussion of the importance of tool use or the importance of tool identification in FFA contests and degrees could be included. Another method of motivation might include asking students to name several tools; some of which they wouldn't be able to identify.

Presentation:

1. Discuss the importance of tool use in agriculture and in agriculturally related occupations. Also discuss the importance of tool identification in relation to FFA contests and degrees.
2. If appropriate, discuss safety rules, shop clean-up, and other shop procedures the students need to know at this time.
3. Move through the shop with the group. Point out such things as fire escapes, evacuation procedure, and fire extinguishers. Any restrictions and special information the students need, can be discussed.
4. Give the students a list of the tools they will be expected to identify. They can take notes on these as you cover the individual tools.
5. Discuss each tool on the list. You may want to briefly explain the use of the tool and demonstrate its use. Students may be allowed to try out certain tools during the discussion. Be sure to discuss any applicable safety precautions as necessary.
6. Assign reading from available textbooks that may apply.

Tryout Experience:

Have students practice by displaying particular tools and asking questions about the identity and use of the tool. Have the students list the shop safety rules that were discussed. Use attached handouts where appropriate.

Followup:

1. Give frequent quizzes on tool use and identification.
2. Include tool use and identification on the unit test.

Equipment:

1. Tool list for each student.
2. Examples of each tool on the tool list.
3. Scrap wood for tool tryout if applicable.

References:

"Interstate Tool Identification Packet", The Interstate,
19-27 Jackson St., Danville, Illinois.

"Metalworking-Tool Identification Test", "Woodworking-Tool
Identification Test", Safety Rules, 3727 Joan Drive,
Waterloo, Iowa 50702.

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Co., Inc., South Holland, Illinois, 1979, pp. 8-23.

Wakeman, T.J., and McCoy, Vernon Lee, The Farm Shop, The
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TOOL LIST

<u>TOOL</u>	<u>USE</u>	<u>COMMENTS</u>
Hammers OH-1 Blacksmith Hammer	a. Used to shape hot and cold metal.	b. Come in weights of 1# to 14#.
Ball Peen-Hammer	a. Used for riveting and general purpose metal works.	b. Machinest hammer Other machinest hammers include straightpeen and crosspeen hammer.
Nail Puller	a. Used for pulling nails.	b. Pulls nails that are driven flush with a minimum of surface damage.
Claw Hammer, curved	a. Driving and pulling nails.	b. The claws are more curved than those on a ripping hammer.
Claw Hammer, ripping	a. Driving nails and separating lumber.	b. The claws are quite straight.
File Card	a. Used for cleaning file teeth.	b. Looks like a wide, flat wire brush.
Taper File	a. Saw tooth sharpening.	b. Triangular shape sizes: Regular, Slim, Extra Slim Double-Extra Slim.
Flat File	a. A general purpose file for rough filing.	b. A flat file can a rasp, or a a double cut. A flat file is always double cut(OH-3).
Mill File	a. Used in regular and draw filing.	b. A mill file is similar to a flat file but it is always single cut. (OH-3)

- | | | |
|-----------------|---|---|
| Round File | a. File curved surfaces and enlarging round holes. | b. Cuts of files: rough, coarse, bastard, second cut, smooth, dead smooth circular shape. |
| "Surform" Plane | a. Used for cutting and shaping wood, aluminum, copper, plastic, tile, and metal no harder than mild steel. | b. Combination of a plane and file. Various blades can be used. |
| Half-Round File | a. Filing curved surfaces. | a. Flat on one side and convex on the other. |
-

Screwdrivers:

- | | | |
|----------------------|---|---|
| Offset Screwdriver | a. Used in hard to reach places. | b. Can have regular or phillips tips. |
| Phillips Screwdriver | a. For use with only Phillips head screws. | b. Comes in sizes from 1# to 4# and in various lengths. |
| Flat Screwdriver | a. Most frequently used screwdriver for slotted screws. | b. Comes in various widths and lengths. Other screwdriver shapes include: square, clutch, and torx. |
-

Squares:

- | | | |
|------------------------|--|---|
| Try Square | a. Used for squaring ends, checking flatness, and squareness. | b. Comes with a 6" or 12" blade. |
| Framing Square | a. Used for carpentry layout. | b. Also known as a Carpenter's Square or Steel. |
| Adjustable Combination | a. Used for checking and laying out 90 to 40 degree angles. A spirit level is usually located on the head. | b. Usually used with a 12" steel blade. A center head or a bevel protractor head can also be used on the steel blade. |

Sliding
Tee Bevel

a. Used to transfer angles.

Sheetrock
Square

a. Used when marking sheets
of plywood or sheetrock.

Clamps:

"C" Clamp

a. Can be used for wood or metal. Be sure to protect the workpiece from damage when using to clamp wood.

b. Can be purchased in various sizes.

Hand
Screws

a. Generally used for clamping wood.

b. Can be purchased in various sizes.

Bar Clamp

a. For clamping several pieces of wood together.

b. Use wood bars, metal bars, or pipe.

Planes:

Smoothing

a. Used for smoothing short, straight surfaces and long, irregularly shaped surfaces.

b. 8"-10"

Block

a. Used primarily for jointing the ends of lumber.

b. 6"-7" The bevel of the plane iron is turned up.

Jack

a. All purpose plane.

b. 14"

Jointer

a. Used to straighten and smooth the edges of long stock.

b. 18"-24" The 18" plane is usually called a fore plane.

Spokeshave

a. Used on curved and irregular surfaces.

b. Similar to a small plane with handles (OH-4)

Chisels:

Wood
Chisel

a. For cutting wood.

b. Comes in widths from 1/8" to 2" Always use a soft face hammer or mallet on a wood chisel.

- | | | |
|----------------------|--|---------------------------------------|
| Cold Chisel | a. For metal cutting. | b. Can be purchased in various sizes. |
| Round Nose Chisel | a. Used for cutting circular grooves and rounded corners. | |
| Cape Chisel | a. Used to cut keyways and narrow grooves with square corners. | |
| Diamond Point Chisel | a. Used for cutting v-shaped grooves and square corners. | |
-

Punches:

- | | | |
|----------------|--|---|
| Center Punch | a. Used for marking and starting holes. | b. Always use before starting to drill metal. |
| Pin Punch | a. Used to drive out cotter pins and tapered pins. | b. Long, constant diameter |
| Aligning Punch | a. Used to arrange holes. | b. Long, slim taper |
| Starting Punch | a. Used to drive pins, rivets and bearings. | b. Long, gentle taper from the body to the tip. |
-

Levels:

- | | | |
|-------------------|--------------------------------------|--|
| Carpenter's Level | a. Used to indicate level and plumb. | |
| Cabinet Level | | b. Usually shorter than a carpenter level. |
| Plumb Bob | a. Measuring Plump | |
-

Measuring Devices:

- | | | |
|-------------------|--|--|
| Spring Joint Rule | a. Widely used in woodworking in making long measurements. | b. Folding wood Rule: Standard size is 6 foot long. |
| Steel Tape | a. To measure straight surfaces but flexible enough to measure curved and irregular. | b. Comes in a variety of lengths. Layout Tape Rule, Long Tape. |

Flexible Steel Rule	a. For measuring curved surfaces.	b. Come in lengths from 12" to 72".
Scratch Awl	a. Used for marking steel.	b. A scribe can also be used for marking steel. A scratch awl has a hardwood handle.
Chalk line	a. Used for laying out straight lines,	b. A line level can be used with a chalk line.
Wing Dividers	a. Used for marking circles and stepping off equal lengths.	
Calipers, Inside	a. Used to measure inside dimensions.	
Calipers, Outside	a. Used to measure outside dimensions.	
Putty knife	a. Scraping, glazing,	b. Come in various widths to suit the use.

Drills:

Breast Drill	a. For hand drilling larger sized holes.	
Hand Drill	a. Used for drilling small holes.	
Bit Brace Drill	a. Used with auger bits.	b. Can also be used with screwdriver bits, expansion bits, etc...with tang. shank.
Automatic Push Drill	a. Used for drilling small holes.	

Drill Bits:

Auger Bit	a. Boring holes in wood.	b. The number indicates size by 16ths of an inch.
Countersink	a. Counter sinking wood before placing wood screws.	

Rose Countersink Bit	a. Counter sinking in wood before placing wood screws.	
Fostner Bit	a. Drilling holes in wood using a press drill.	b. Drill flat bottom holes.
Expansion Bit	a. Drilling large size holes in wood.	b. Adjustable to drill different size holes.
Twist Drills	a. Generally used in metal.	b. Come with a variety of shank shapes.
Star Drills	a. Generally used for drilling concrete or masonry.	

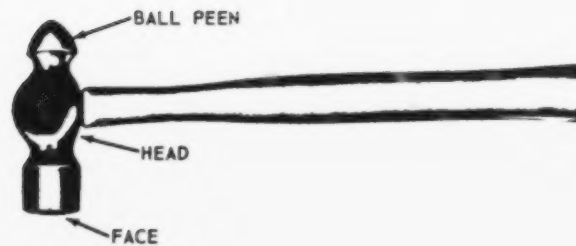
Hatchets & Saws:

Standard Half Hatchet	a. Used for making stakes and building concrete forms.	b. Used for rough cutting, splitting, and notching.
Shingle Hatchet	a. Single when using wooden shingles.	b. Generally used by roofers installing wood shingles.
Saw Set	a. Setting saw teeth.	
Rip Saw	a. Cutting wood with the grain.	b. Generally fewer points than a crosscut saw.
Crosscut Saw	a. Cutting wood across the grain.	
Compass Saw	a. Used for cutting wood to irregular shapes.	b. Sometimes called keyhole saw.
Backsaw	a. Used for fine cutting across the grain.	b. How many teeth per inch.
Coping Saw	a. Used for cutting irregular shapes.	
Adjustable Hacksaw	a. Used for metal cutting.	b. Blades can be purchased with different numbers of teeth per inch.

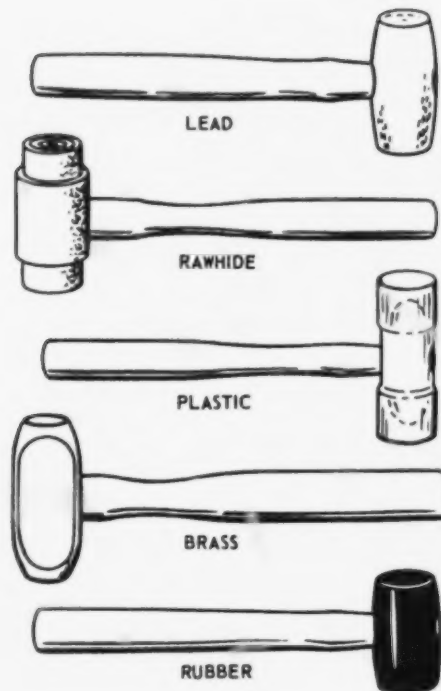
Misc...:

- | | | |
|---------------|---|---|
| Miter Box | a. Used for squaring stock and cutting angles. | b. A backsaw is generally used in a miter box. |
| Nail Set | a. Used for "setting" nails below the wood surface. | b. Comes in sizes from 1/32" to 5/32" by 1/32ths. |
| Wheel Dresser | a. Used for smoothing grinding wheels. | b. The cutting wheels are usually replaceable. |
| Wrecking Bar | a. Pulling large nails and paying. | b. The thickness increases with the length. A 3/4"x24" "goose neck" wrecking bar is common. |
| Marking Gauge | a. Used to lay out parallel lines or transfer dimensions. | |

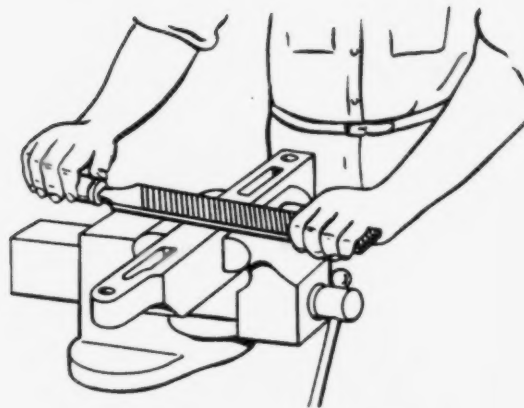
BALL PEEN HAMMER



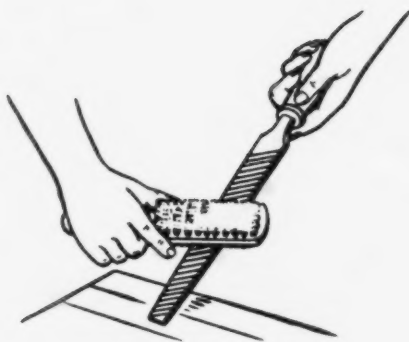
SOFT HAMMERS



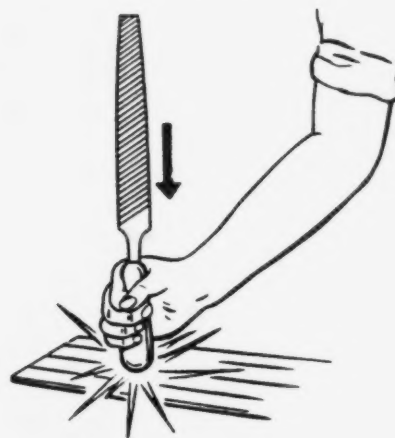
FILE USE



CORRECT METHOD OF DRAW-FILING

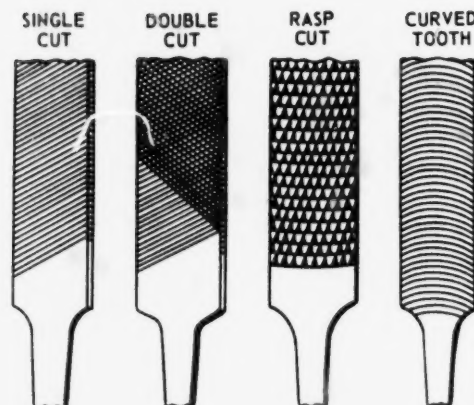


USING A FILE CARD
TO CLEAN A FILE

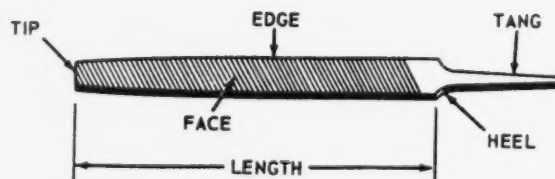


TIGHTENING A FILE
HANDLE CORRECTLY

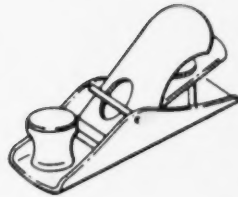
TYPES OF FILES



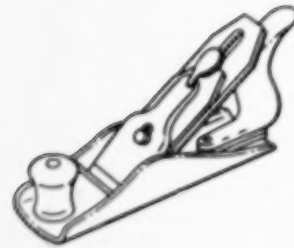
FILE PARTS



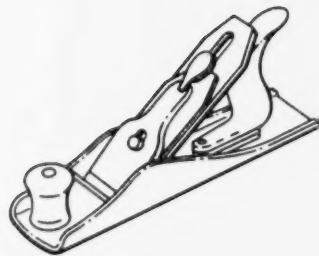
PLANES



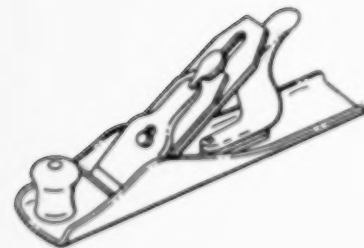
BLOCK



SMOOTHING



JACK



JOINTER

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 2: Hacksaws, Files and Whetstones

Estimated Time Required: One period.

Need:

In order to care for hand tools properly, students need to be able to use several basic hand tools. Students need to be able to select files and whetstones and use them properly when sharpening hand tools.

Objectives:

Upon completion of this lesson, students should be able to:

1. Identify different types of files.
2. Identify the parts of a file.
3. Choose the proper file for a specific job.
4. Use a file properly.
5. Choose the proper hacksaw blade for a specific job.
6. Properly install a hacksaw blade.
7. Use a hacksaw properly.
8. Select and use a whetstone properly.

Interest Approach:

One motivation technique would be to let a student try to cut metal with a hacksaw that has an incorrectly installed blade. Discuss with the class what the problem may be. Another motivation technique would be to show the students several types of files and ask for examples of the use of each.

Presentation:

This lesson is divided into three sections concerning hacksaws, files and whetstones. The instructor may elect to teach the section on whetstones in one of the lessons where whetstones are used.

I. Filing Cold Metal

<u>Questions</u>	<u>Discussion</u>
1. Why do we use files?	1.1 Shape cold metal 1.2 Test hardness of metal 1.3 Polish metal
2. What are the parts of a file?	2.1 Tang 2.2 Heel 2.3 Body 2.4 Belly 2.5 Edge teeth 2.6 Point
3. In what shapes are files manufactured?	3.1 Flat (mill) 3.2 Half round 3.3 Round 3.4 Taper (triangular) 3.5 Square
4. What are the types of file cuts?	4.1 Single and double cut
5. Why is there a difference in file cuts?	5.1 Single cut is for smooth filing, double cut is for faster, rougher cuts.
6. How do you describe the size of a file?	6.1 Length--The distance from the point to the heel.
7. What are the different cuts of a file?	7.1 Rasp, single cut, and double cut. A rasp has individual cutting teeth.
8. What are the terms used to describe how coarse a file is?	8.1 Rough, coarse, bastard, second cut, smooth, dead smooth.
9. What is the difference between a flat file and a mill file?	9.1 A flat file is always double cut, a mill file is always single cut.
10. What are the different types of triangular files?	10.1 Regular, slim, extra slim, and double extra slim.

11. How do you use a file?

11.1 Normal filing:

- a. Push the file with pressure on the forward stroke.
- b. Use approximately 30 strokes per minute.
- c. A slight side motion may help keep the workpiece smooth.
- d. Work diagonally on large pieces.

11.2 Draw filing:

- a. Use a mill file. (single cut)
- b. Hold the file between your hands and push it across the workpiece at a right angle to the piece.
- c. Use pressure on the forward stroke.
- d. Slight sideways travel may help.

SAFETY NOTE: ALWAYS USE A HANDLE ON A FILE!!

12. Why should we keep the files clean?

- 12.1 Clean files cut faster.
- 12.2 Material buildup can scratch the workpiece.

13. What should you use to clean a file?

- 13.1 A file card works best.
- 13.2 A hand wire brush can also be used.
- 13.3 NOTE: Never use a power wire brush.

TIP: RUBBING CHALK ON A FILE WILL HELP KEEP IT CLEAN WHEN FILING SOFT MATERIAL

14. How do you care for files?

- 14.1 Protect the teeth from damage.
- 14.2 Keep files dry to prevent rust.
- 14.3 Never store files so they are laying against metal.

II. Using an Adjustable Hacksaw

<u>Steps</u>	<u>Key Points</u>
1. Select the blade	1.1 Allow 2-3 teeth in contact with the metal as it is being cut. 1.2 Blades commonly come 14, 18, 24, and 32 teeth to the inch. 1.3 Blades commonly come in lengths of 8", 10", and 12". 1.4 Blades come in several alloys and heat treatments depending on the hardness of the material to be cut. 1.5 There are two types of hacksaw tooth sets: a. Raver Set 1. More expensive 2. Lasts longer b. Wavy Set 1. Less expensive 2. Doesn't last as long.
2. Insert the blade.	2.1 Insert the blade in the frame so the teeth are pointing <u>away</u> from the handle.
3. Tighten the blade in the frame.	3.1 Must be tight enough to prevent buckling or breaking during use. 3.2 A properly tightened blade will produce a humming noise when picked with the thumb.
4. Retighten the blade after a few strokes.	
5. Mark the stock to be cut with a file.	5.1 A thin line is easier to follow than a thick chalk line.
6. Clamp the material to be cut in a vise if possible.	6.1 Have the cut line approximately 1/2" from the vise.

- 6.2 Clamp thin stock such as sheet metal between boards to prevent vibration and aid cutting.
- 7. Start the cut.
 - 7.1 Hold the saw with both hands.
 - 7.2 Pull the saw towards the body to start the cut.
 - 7.3 Extend the index finger along the frame to help guide the saw.
 - 7.4 Nicking the workpiece with the corner of a file is a good way to start a cut.
- 8. Continue the cut.
 - 8.1 Apply pressure only on the forward stroke.
 - 8.2 Use only enough pressure to make the teeth cut.
 - a. Too much pressure may cause the blade to break.
 - b. Too little pressure will dull the blade.
 - 8.3 Use long even strokes.
 - 8.4 40 to 50 strokes per minute is about correct.
 - 8.5 If the blade starts to cut to one side it is best to turn the work over and start from the other side.
 - 8.6 If a blade breaks in a cut, turn the work over and start from the other side with a new blade. Do not use a new blade in an old cut.

III. Selecting and Using a Whetstone Properly

<u>Questions</u>	<u>Discussion</u>
1. What is another name for a whetstone?	1.1 Oilstone
2. Why is a whetstone called an oilstone?	2.1 Oil is used liberally while using an oilstone. a. Oil floats off the small cuttings of steel. b. Oil keeps the stone from becoming clogged with dirt. c. A dry stone soon becomes slick and will not cut properly.
3. What type of oil should you use on an oilstone?	3.1 Penetrating oil 3.2 Light oil/kerosene mix 3.3 <u>Never</u> use turpentine.
4. What do we use an oilstone for?	4.1 Putting a keen edge on metal cutting tools.
5. What types of oilstones are available?	5.1 Natural stones a. Arkansas--comes in hard and soft grades. b. Washita--similar to Arkansas stone, very good for sharpening. 5.2 Artificial stones a. India oilstones b. Crystolon oilstones
6. What type of oilstone is normally used in a shop?	6.1 Artificial stones are most often used because they are generally more uniform. 6.2 Combination oilstones with a coarse or medium side and a fine side are commonly used.
7. How do you clean an oilstone?	7.1 Wash it in kerosene.
8. What are some important points to remember about using an oilstone?	8.1 Keep the stone clean. 8.2 Stones are fragile, handle them with care. 8.3 Use a liberal amount of oil.

- 8.4 Use the whole stone to avoid dishing out the center.

NOTE:

There are now many artificial sharpening devices on the market that can be used when sharpening tools. It is suggested that the instructor obtain several samples of these and include them in the sharpening unit. Use the directions that come with these stones as a teaching guide.

Tryout Experience:

A suggested shop project is included in the lesson that would give students experience in the use of files and hacksaws.

Followup:

1. The tryout project will be graded.
2. Information given in the lesson will be covered in quizzes and in the unit test.

Equipment:

1. Material for the shop project.
2. Various types of files.
3. Hacksaw frames and various blades.
4. Examples of whetstones.
5. Wood blocks
6. Thin metal sample
7. Scratch awl
8. Square
9. Measuring device

References:

Jones, Mack M. Shopwork on the Farm, McGraw-Hill Book Co. Inc., New York 2nd Ed. 1955, pp. 205-206;366-380.

Wakeman, T.J., and McCoy, Vernon Lee, The Farm Shop, The MacMillan Company, New York, 1960, pp. 88-90.

Wagner, Williw H., Modern Carpentry, The Goodheart-Willcox Co., Inc., South Holland, Illinois, 1979, pp. 20-22.

The New American Machinists' Handbook, McGraw-Hill Book Co., Inc., New York, 1955, pp. 5-58.

Nicolson File Company (Booklets)

Suggested Shop Project: Lesson Two

Purpose:

This is a simple project designed to give students experience in several skills using a hacksaw and file. This project can also be used for practicing grinding and honing plane irons in later lessons.

Skills Included:

1. Cutting with a hacksaw.
2. Normal filing
3. Draw filing.
4. Measuring.
5. Marking with a square and scratch awl.

Materials Needed:

One strip of flat iron about 7 inches long, 3/16 inches thick and 1 1/2 inches wide.

Tools Needed:

1. Hacksaw and blades
2. File
3. Measuring device
4. Square
5. Scratch awl

Instructions:

The finished piece should be 6 inches long with each end cut as square as possible with a hacksaw. Drawfile one long side and normal file the other. Both edges should be filed as smooth as possible. Do not file the ends. Students should be required to sketch the project.

Grading Criteria

1. Were directions followed?
2. Is the length correct?
3. Are the ends cut squarely?
4. Is the drawfiled edge smooth?
5. Is the normal filed edge smooth?
6. Was the project completed on time?
7. Was the project sketched properly?

GRINDING, HONING, AND LAPPING

OILSTONES AND THEIR USES

Natural Stones

The following particulars regarding the well-known Arkansas and Washita stones are given by the Behr-Manning Div., Norton Co.

Arkansas stones are prepared in two grades, hard and soft.

Hard Arkansas stone is composed of pure silica, and its sharpening qualities are due to small, sharp-pointed grains, or crystals, of hexagonal shape, which are much harder than steel and will, therefore, cut away and sharpen steel tools. The extreme fineness of texture makes this of necessity, a slow cutter, but in the very density of the crystals of which it is composed lies its virtue as a sharpener.

Soft Arkansas stone is not quite so fine-grained and hard as the hard Arkansas, but it cuts faster and is better for some kinds of mechanical work. It is especially adapted for sharpening the tools used by wood carvers, filemakers, patternmakers, and all workers in hardwood.

Washita stone is also found in Arkansas and is similar to Arkansas stone, being composed of nearly pure silica, but is much more porous. It is known as the best natural stone for sharpening carpenters' and general woodworkers' tools.

Artificial Oilstones

Artificial oilstones are manufactured in a multitude of shapes and sizes and are adapted for sharpening all kinds of tools. Such stones are made of Alundum and Crystolon, by the Norton Co., the former being known as India oilstones, the latter as Crystolon sharpening stones. Similar shapes are manufactured by the Carborundum Co. and others.

The stones are made in three grades or grits-coarse, medium, and fine. The coarse stones are used in machine shops for sharpening very dull or nicked tools and machine knives and for general use where fast cutting is desired.

Medium stones are for sharpening mechanics' tools in general, more particularly those used by carpenters and in woodworking shops.

Fine stones are adapted for engravers, die workers, cabiners makers, and other users of tools requiring a very fine, keen-cutting edge.

How to Care for Oilstones

To retain the original freshness of the stone, it should be kept clean and moist. To let an oilstone remain dry a long time or to expose it to the air tends to harden it. A new natural stone should be soaked in oil for several days before it is used.

To keep the surface of an oilstone flat simply requires care in using it. Tools should be sharpened on the edge of a stone as well as in the middle.

To restore an even, flat surface, grind the oilstone on the side of a grindstone or rub it down with sandstone or an emery brick.

An oilstone can be prevented from glazing by use of oil or water.

Water-and plenty of it-should be used on all coarse-grained natural stones.

On medium-and fine-grained natural stones and in all artificial stones, oil should be used always as water is not thick enough to keep the steel out of the pores.

Further to prevent glazing, the dirty oil should always be wiped off the stone thoroughly as soon as possible after using it. Cotton waste is good for this.

If the stone does become glazed or gummed up, a good cleaning with gasoline or ammonia will usually restore its cutting qualities, but if it does not, then scour the stone with loose emery or sandpaper fastened to a flat board.

Never use turpentine on an oilstone for any purpose.

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 3: Can You Use a Power Grinder Safely?

Estimated Time Required: One period

Need For Lesson:

Students will soon be sharpening plane irons, wood chisels, and other tools that require the use of a power grinder in the sharpening process.

Objectives:

Upon completion of this lesson, students should be able to:

1. Answer all questions correctly on a power grinder safety test.
2. Select a grinding wheel for a specific purpose.
3. Correctly install a grinding wheel.
4. Correctly dress a grinding wheel with a wheel dresser.
5. Set up and use a power grinder properly and safely.

Motivation:

Let one of the students try to file some fairly hard steel, then show the class how much easier it is to use a power grinder. Relate what can happen if there is a power grinder accident to stress the necessity of safe operation.

Presentation:

- A. Stress the need for safety and explain to the students that they will have to pass a safety test before they will be allowed to use a power grinder.
- B. Be sure to remind the students of your policy concerning the wearing of safety glasses.

Questions

1. What would you use a power grinder for?
2. What are some types of power grinders?

Discussion

- 1.1 Maintain many cutting tools which are too hard to file.
- 1.2 Smoothing weld joints
- 1.3 Preparing metal for welding
- 1.4 Polishing
- 2.1 Bench grinder
 - a. Self-contained (3450 RPM)
 - b. Belt-driven (1750 RPM)
- 2.2 Pedestal grinder, usually self-contained with two grinding wheels.
- 2.3 High and low speed grinders
 - a. Low speed--for grinding highly tempered tools.
 - b. High speed--for general purpose grinding.

SAFETY NOTE: MAXIMUM RIM SPEED MUST BE LESS THAN 4200 FEET PER MINUTE.
Rim speed = Circumference in feet X RPM of arbor shaft.
PROBLEM: What is the rim speed of an 8" diameter wheel at 3450 RPM?

3. What are the parts of a power grinder?
4. How do you select a grinding wheel?
 - A. Abrasive types

- 3.1 Wheel Guard
- 3.2 Safety Shield
- 3.3 Wheel
- 3.4 Tool Rest
- 3.5 Dust chute
- 3.6 Motor
- 3.7 Switch
- 3.8 Base
- 3.9 Arbor
- 4.1 A--Aluminum oxide
 - a. Tough
 - b. Used for steel, malleable iron, and bronze.

- B. Grain size (grit)
 - 4.2 C--Silicon carbide
 - a. Hard, brittle
 - b. Used for cast iron, aluminum, copper, bronze, and non metallic materials.
 - 4.3 Grit--The number of cutting particles per linear inch.
 - a. Fine (100 to 120), for fine cutting edges such as knives and plane irons.
 - b. Medium (60), for edges like hatchets, welding areas, and heavy chisels.
 - c. Coarse (20 to 30), for cast iron and heavy iron castings.
 - 4.4 Runs from A = soft to Z = hard.
 - 4.5 Soft wheels will not draw the temper from edge tools as quickly as hard wheels, but will wear faster.
 - 4.6 The proper grade wheel should shed particles gradually.
 - C. Grade (hardness)
5. How do you install a grinding wheel?
- 5.1 Check the wheel to be installed for cracks.
 - a. Strike the stone lightly with a small hammer.
 - b. If the wheel is sound it will ring, if it is cracked it will thud.
 - 5.2 Place the wheel on the arbor.
 - a. Be sure the wheel fits snugly on the arbor. A bushing may be necessary.
 - b. There should be a flange on each side of the stone. Do not remove the paper disks from the wheel.

- 5.3 Moderately tighten the nut, too tight may crack the wheel.

SAFETY NOTE: A STONE SHOULD NEVER BE USED IF IT IS LESS THAN 1/2 ITS ORIGINAL DIAMETER.

6. How do you set the tool rest?

6.1 The tool rest should be set close to the wheel (about 1/8").

6.2 The tool rest should be level and perpendicular to the center of the arbor.

NOTE: Go through the power grinder safety precautions.

NOTE: Demonstrate the steps to be taken when truing a grinding wheel.

Tryout:

1. Let the students use the grinder on scrap metal after they have passed their grinder safety test. Students could practice grinding the ends smooth on the project workpiece from lesson two.
2. Have students demonstrate individually how to true a grinding wheel.

Followup:

1. Students must pass a grinder safety test.
2. Students must demonstrate the use of the grinder to the instructor.
3. Material from this lesson will be covered on quizzes and the unit test.

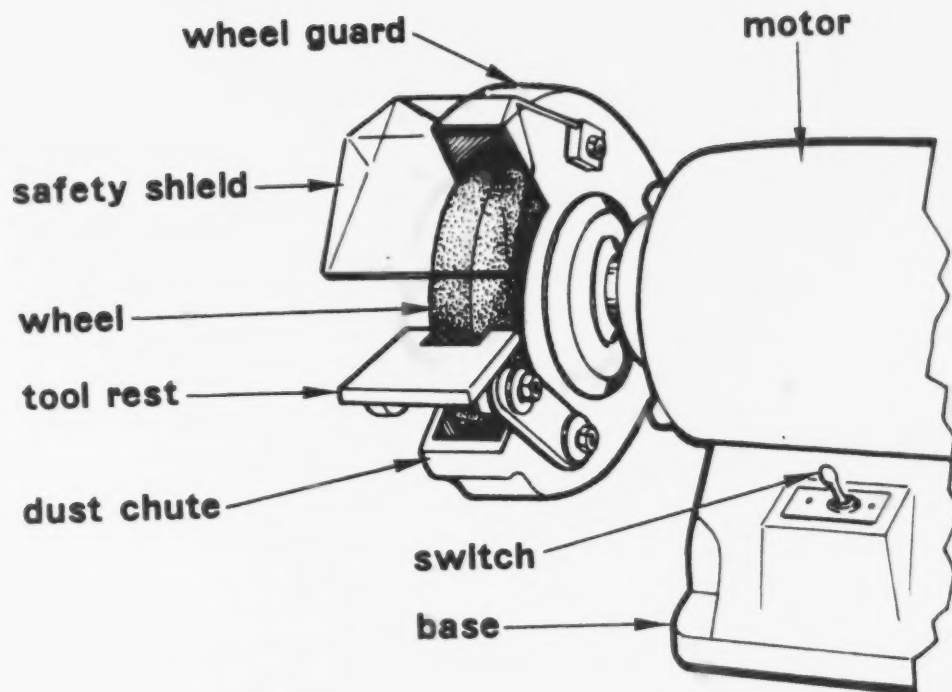
Materials:

1. Power grinders
2. Various grinding wheels
3. Safety glasses
4. Wheel dressers
5. Practice scrap metal
6. Grinder safety quizzes
7. Project workpieces if applicable.

References:

Jones, Mack M., Shopwork on the Farm, McGraw-Hill Book
Company, Inc., pp. 200-205.

PARTS OF A GRINDER



POWER GRINDER SAFETY PRECAUTIONS

1. Always wear safety glasses.
2. Obtain your instructor's permission to use the grinder.
3. Never wear loose clothing when using a grinder.
4. Keep all safety devices and guards in good working order and in place.
5. Make all adjustments with the power off.
6. Do not use a grinder unless the plastic shield on the grinder is in place.
7. Keep the tool rest adjusted to within 1/8" of the stone at all times.
8. Always check stone for tightness and for cracks or flaws before using.
9. Keep the guard adjusted as near the wheel as possible.
10. Keep the grinding wheel true by frequent dressing.
11. Never use grinding wheels which have been worn down by use. Never use a wheel after it has been worn to less than $\frac{1}{4}$ its original size.
12. Use the face of the grinding wheel, not the sides for grinding.
13. Never allow the hands and fingers to contact the grinding wheel when it is in motion.
14. Always use pliers, vice-grips or other suitable holding devices when grinding small, round or oddly shaped workpieces.
15. Never force the job against the grinding wheel, and avoid overloading the grinder.
16. When starting a new wheel, stand back and allow it to run for a few minutes before using it for grinding.
17. Never apply the job to the grinder before it has reached running speed or while it is coasting to a stop.
18. Be sure to keep work piece cool by frequent dipping in cold water.
19. Always stand to one side of the wheel when using the grinder.
20. When shutting off, wait until the grinder completely stops before leaving the area.

JOB OPERATION SHEET

LESSON: Truing a Grinding Wheel

STEPS	STANDARD PROCEDURE AND SPECIFICATION	SAFETY & KEY POINTS
1. Gather the equipment	a. Eye shield, dressing tool, wrench, combination square	
2. Adjust tool rest	a. Move tool rest in line with the center of the arbor. b. Leave 1/16" to 1/8" clearance between tool rest and the wheel. c. Adjust tool rest in a flat position.	a. Rotate the grinding wheel by hand to be sure it does not hit the tool rest
3. True the wheel	a. Turn on the switch and let the grinder come to full speed. b. Grasp the wheel dresser with both hands. c. Place dresser on tool rest with 1/3 of the cutter over right edge d. Move dresser across the grinding wheel until 1/3 of cutter extends over the left edge. e. Repeat as necessary.	a. Be sure to put on eye goggles or face shield. b. Hold hands close to the body. c. Hold wheel dresser firm against wheel to prevent sparks. Sparks means the cutter is being ground away.
4. Check roundness of the wheel	a. Turn wheel by hand and check distance between wheel and rest. b. Turn through one complete revolution.	a. If distance between the tool rest on wheel is not the same, the wheel is not round.
5. Check the squareness of the wheel face.	a. Place a combination square against the face of the wheel.	a. Make certain wheel is not turning.

STANDARD MARKINGS FOR GRINDING WHEELS

<u>ABRASIVE</u>	<u>GRAIN SIZE</u>	<u>GRADE</u>	<u>STRUCTURE</u>	<u>BOND</u>	<u>SYMBOL</u>
A- Aluminum Oxide	Coarse	10 SOFT	E DENSE	1 V	On certain wheels
		12 V Soft	F Close	2 (Vitrified)	
		14	G	3	a letter or numeral
		16	H	4	
		20 Soft	I Med.	5	be shown to indicate
C- Silicon Carbide		24	J	6	S
		30	K	7	(Silicate)
		36	L	8	a special type of
	Medium	46 Med.	M TO	9 B	bond or treatment.
		54	N	10 (Resinoid)	
		60 TO	O Open	11	
		70	P	12 R	
		80	Q	13 (Rubber)	
	Fine	90 Hard	R	14	
		100	S	15 E	
		120	T OPEN	(Shellac)	
		150	U		
		180	V		
	Very Fine	220 V Hard	W		
		240	X		
		280	Y		
		320	Z		
		400 HARD			

Grinding Wheel Recommendations

Brass (H speed) C16-Q4B
 Cast Iron (H speed) A16-P4B
 Cemented Carbides (rough) C60-L8V
 (finish) C100-H8V
 Chisels (sharpen) A100-H8V
 Composition Board C24-Q8R
 Concrete (cut.) C24-Q8R
 Copper (cut.) C36-P6R

Drills, Twist (sharpen) A80-L6V
 Plows (surfacing) A16-S5V
 Scissors & Shears A120-P5V
 Steel Castings (high speed) A14-Q4B
 Stellite (tools) A46-M5V
 Tools, woodworking (carbon & HSS) A160-L5V-6
 Valves (engine) A70-O5V
 Welds (hvy dty) A24-B

HANDOUT

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 4: How Do You Sharpen Hand Tools?

Estimated Time Required:

This lesson will take perhaps one period for every two tools covered. Time spent and tools covered is at the discretion of the instructor.

Need For Lesson:

As agricultural profit margins become tighter, it is more and more important to obtain the maximum benefit from resources. Students who can properly sharpen tools will save time and money in the long run. A sharp tool is a safer tool.

Objectives:

Upon completion of this lesson, students should be able to properly sharpen:

1. Plane irons and wood chisels.
2. Knives
3. Axes and Hatchets
4. Metal chisels
5. Punches
6. Twist drills
7. Auger bits
8. Tin snips and scissors

Motivation:

One motivation technique would be to let a student with a dull pocket knife try to cut a piece of rope. Then have him/her use a sharp knife. Stress the need for sharp tools. Make the point that sharp tools are more safe than dull tools.

Presentation:

This lesson is divided into eight sections. The instructor must decide which tools to sharpen. It may be advantageous to cover several tools at a time to allow more effective use of available resources.

Section 1: How Do You Sharpen a Plane Iron and Wood Chisel?

A. Grinding a plane iron or wood chisel.

1. Why would you grind a plane iron or wood chisel?

- a. To remove nicks.
- b. When the concave bevel has been removed by whetting.
- c. When the edge is not square.

Steps

Key Points

SAFETY NOTE: DON'T FORGET YOUR SAFETY GLASSES!

1. Joint the end of the plane or chisel.

- 1.1 Place the iron on the center of the stone.
- 1.2 Move the iron left or right.(OH-1)

NOTES:

- a. You can use the iron cap as a guide.(OH-2)
- b. Be sure to keep the tool cool.
- c. Use a fine grain (abt. 80 grit) soft stone.

- 1.3 Use a tri-square to check the angle.

2. Grind the angle.

- 2.1 Make sure the tool rest is square with the wheel.
- 2.2 The tool rest can be used as a guide. It can be set at 25 degrees to the stone.
- 2.3 Grind the edge until a wire edge appears.
- 2.4 The angle on a plane iron or wood chisel should be between 25 and 30 degrees. Use the larger angle for harder wood.
- 2.5 Check the angle with an accurate tool gauge.

NOTE: A sliding tee bevel square can be used by setting it at 6 and 3 on a carpenter's square.

REMEMBER NOT TO LET THE TOOL GET HOT!

WHY: If the tool gets too hot the cutting edge will be annealed (softened).

B. Whetting a Plane Iron or Wood Chisel

1. When should you whet a plane iron or wood chisel?
 - a. When the edge is dull but does not need grinding.
 - b. After grinding.
2. How do you tell when the edge is dull?
 - a. When held to the light, a dull edge will look bright because it is rounded.
 - b. If the tool is not cutting properly.

Steps

Key Points

SAFETY NOTE: BE CAREFUL, THE EDGE WILL BECOME VERY SHARP!

- | | |
|---|---|
| 1. Clean the oilstone. | 1.1 This is to prevent dust from being worked into the stone. |
| 2. Apply light oil to stone. | 2.1 Penetration oil or an engine oil/kerosene mix will work. |
| 3. Place the iron or chisel on the stone. | 3.1 Have the cutting edge in contact and the heel in contact or slightly raised. |
| | 3.2 Use a circular or back and forth motion. |
| | 3.3 Utilize as much of the stone as possible to prevent the stone being hollowed out. |
| | 3.4 This takes only a few strokes. |
| | 3.5 Keep plenty of oil on the stone. |

Question: What problems will you have if you use a hollowed out stone?

It will be difficult to maintain a square edge.

- | | |
|------------------------------------|---|
| 4. Whet the flat side of the iron. | 4.1 Be sure the iron is flat on the stone. |
| | 4.2 This removes the wire edge. |
| 5. Test the edge for | 5.1 Hold the edge to the light, a dull edge is bright |

5.2 Test it for smoothness by lightly and carefully feeling it with the thumb or a finger.

6. Repeat steps 3 through 5 if necessary.

Section 1 Materials Needed:

1. Plane iron or wood chisel.
2. Grinder with soft, fine grain stone.
3. Container of cooling water.
4. Tool gauge or sliding tee bevel square and framing square.
5. Safety glasses.
6. Oilstone
7. Light oil
8. Cleaning rags.

Project:

A substitute for plane irons and chisels can easily be made with flat iron. If the project in lesson two was used, the ends will work well for making practice plane irons and wood chisels.

References:

Phipps, Lloyd J., Mechanics in Agriculture, The Interstate Printers and Publishers, pp. 120-126.

Section 2: How Do You Sharpen a Knife?

General Procedure:

1. Produce a course edge by grinding with a grinding wheel or by whetting with the course side of an oilstone.
2. Finish the edge by whetting on the fine side of an oilstone.
3. If a very fine edge is needed, it can be produced by stropping the knife on leather or using a sharpening steel.

Steps

Key Points

SAFETY NOTE: DON'T FORGET YOUR SAFETY GLASSES!

1. Grinding a knife.

- 1.1 Use a grinder if a knife is nicked or extremely dull.
- 1.2 Use a medium or fine grinding wheel.
- 1.3 Procedure:
 - a. Place the blade flat against the wheel with the point higher than the handle.
 - b. Raise the back edge of the knife just enough to grind on the cutting edge.
 - c. Move the blade slowly back and forth at an angle across the wheel.
 - d. Reverse the knife and grind the other side.
- 1.4 Precautions
 - a. Cool the knife frequently in water.
 - b. Use only moderate pressure.
 - c. Examine the blade frequently.
- 1.5 The blade will usually need to be whet on the coarse side of an oilstone after grinding.

2. Whetting a knife.

- 2.1 Clean the stone.
- 2.2 Apply light oil to the stone.
- 2.3 Place the blade flat on the stone.(OH-3)
- 2.4 Raise the back of the blade just enough to make the cutting edge touch the stone.
- 2.5 Draw the knife diagonally across the stone.
- 2.6 Keep the heel down and use moderate to heavy strokes.
- 2.7 Turn the knife over every two strokes.
- 2.8 Whet on the coarse side until a wire edge is produced.
- 2.9 Whet on the fine side of an oilstone until the wire edge is gone.

- 2.10 Some authorities recommend using a figure 8 pattern on the stone.

SAFETY NOTE: BE CAREFUL, THE EDGE WILL BE VERY SHARP!

- | | |
|------------------------------|--|
| 3. Stropping the knife. | 3.1 Pull the blade over a smooth piece of leather with the cutting edge trailing. |
| | 3.2 Alternate sides and repeat until the knife is sharp. |
| 4. Using a sharpening steel. | 4.1 Hold the steel in the left hand with the point up.(OH-3) |
| | 4.2 Tilt the blade slightly so the cutting edge is in contact with the steel. |
| | 4.3 Beginning at the heel of the blade draw it down quickly using only light pressure. |
| | 4.4 Repeat the motion, alternating sides of the blade until the knife is sharp. |

Section 2 Materials Needed:

1. Oilstone
2. Light oil
3. Cleaning rags
4. Knives to sharpen
5. Power grinder with a fine wheel.
6. Leather for stropping.
7. Sharpening steel.

References:

Jones, Mack M., Shopwork on the Farm, McGraw-Hill Book Company, Inc., 1955, pp.206-210.

Section 3: How Do You Sharpen Axes and Hatchets?

Questions

1. What determines how an axe or hatchet is sharpened?
2. What is meant by the balance of an axe?

Discussion

- 1.1 How the axe or hatchet is going to be used.
 - a. Chopping--a long bevel and thin blade.
 - b. Splitting--a short bevel and thick blade.
- 2.1 When an axe is set with the cutting edge down, 2/3 of the blade would be in front of the part of the blade that touches the ground.

Steps

1. Grind the axe or hatchet to joint or remove nicks.
2. Filing or whetting

Key Points

- 1.1 Lay the axe blade on the tool rest.(OH-4)
- 1.2 Push forward lightly to grind out the nicks.
- 1.3 Check the balance of axes frequently.
- 1.4 Try to maintain the original shape as closely as possible.
- 1.5 Be sure to use a medium or fine grinding wheel.
- 1.6 When grinding an axe, swing the handle back and forth to maintain the original curvature.
- 1.7 Quit grinding when the first sparks appear over the cutting edge.
- 1.8 Turn the axe or hatchet over and grind the other side.
- 2.1 Use a smooth mill file or an oilstone to remove the wire edge left by grinding.

SAFETY NOTE: DON'T FORGET YOUR SAFETY GLASSES!

Section 3 Materials Needed:

1. Axes and hatchets to sharpen
2. Safety glasses
3. Smooth mill file
4. Oilstone and light oil
5. Cleaning rags
6. Grinder with medium or fine grinding wheel.

References:

Phipps, Lloyd J., Mechanics in Agriculture, The Interstate, 1977, pp. 128-129.

Jones, Mack M., Shopwork on the Farm, McGraw-Hill Book Company, Inc., 1955, pp. 212-213.

Wakeman, T.J., and McCoy, Vernon Lee, The Farm Shop, The MacMillan Company, 1960, pp. 47-48.

Section 4: Can You Sharpen Metal Chisels?

<u>Questions</u>	<u>Discussion</u>
1. What do you use a metal chisel for?	1.1 Cutting metals Examples: Cutting rivets and splitting nuts.
2. What types of metal chisels are there?	2.1 Flat cold chisel 2.2 Cape chisel--used for cutting keyways, narrow grooves and square corners. 2.3 Round nose chisel--used for cutting circular grooves and cutting rounded inside corners. 2.4 Diamond point chisels--used for cutting v-shaped grooves and square corners.
3. What is another name for a metal chisel?	3.1 Cold chisel
4. What are some points to remember about using a cold chisel?	4.1 Always wear safety glasses. 4.2 A chisel will cut any metal softer than itself.

- 4.3 Always choose a large enough chisel for the job.
- 4.4 Larger chisels require larger hammers.

Steps

Key Points

SAFETY NOTE: WHAT ABOUT YOUR SAFETY GLASSES?

- | | |
|---------------------|--|
| 1. Redress the head | 1.1 After some use, the head of a chisel will mushroom out. <ul style="list-style-type: none">a. Sharp edges may cut the hand.b. Pieces may break off and fly through the air with great speed. |
| | 1.2 Break off all loose metal. |
| | 1.3 Using a power grinder, square the head with the shank. A slightly convex head works well. |
| | 1.4 Chamfer the edge of the head slightly at about a 20 degree angle to prevent chipping of the edge. This angle is called the crown radius. |
| 2. Remove nicks. | 2.1 Joint the end of the chisel by placing the chisel on the tool rest and pointing it directly toward the center of the wheel. |
| | 2.2 Use a light pressure and grind until all nicks are gone. |
| | 2.3 Check squareness with a try square or combination square. |

SAFETY NOTE: BE SURE TO HOLD THE CHISEL FIRMLY WHILE GRINDING!!

- | | |
|--|--|
| 3. Grind the cutting edge of the chisel. | 3.1 Hold the chisel firmly against the tool rest using a finger as a guide. |
| | 3.2 Hold the chisel at an angle of about 60 degrees to the stone. |
| | 3.3 Grind the cutting edge of the chisel to an angle of 60 to 70 degrees. <ul style="list-style-type: none">a. For most work an angle of 60 degrees works best |

- b. The angle of a cold chisel cutting edge may vary from 55 degrees for cutting very soft metal to 90 degrees for cutting very hard metal.
- c. Turn the chisel frequently so the ground edges are of equal length and the cutting edge is in the center of the chisel.

- 3.4 The end of the chisel should be slightly convex.
- 3.5 Be sure to cool the chisel frequently in water to prevent overheating which will soften the cutting edge
- 3.6 Check the edge being ground frequently for the proper angle and squareness.

4. Test the chisel.

- 4.1 The chisel should cut sheetmetal or rod smoothly.

Section 4 Materials Needed:

- 1. Cold chisels to be ground.
- 2. Safety glasses.
- 3. Container of water for cooling.
- 4. Hammer
- 5. Material for testing chisel.
- 6. Power grinder with a medium or fine grinding wheel.
- 7. Tool gauge and try-square.

References:

Fundamentals of Service-Shop Tools, Deere and Company, 1973, pp. 12-13.

Shinn, Glen C. and Weston, Curtis R., Working in Agricultural Mechanics, McGraw-Hill Book Co., 1978.

Section 5: How Do You Sharpen a Center Punch?

NOTE: Although the title of this section concerns center punches, other types of punches are included.

Questions

Discussion

- | | |
|--|---|
| 1. What are some different types of punches and what are their uses? | 1.1 Starting punches--have a long gentle taper from the body to the tip.
Uses:
a. Start driving out taper or straight pins.
b. Driving out rivets. |
| | 1.2 Pin punches--have a long constant diameter shank. Pin punches are used to drive out pins after the starting punch can no longer be used. |
| | 1.3 Center punches--have a point that is ground to 60 degrees.
Center punches are used to mark a location to be drilled. Starting a hole with a center punch will keep the drill bit from wandering. |
| | 1.4 Aligning punches--have long slim tapers. Aligning punches are used to align corresponding holes. |
| 2. What are some things to remember when using punches? | 2.1 Always wear safety glasses when using punches.

Small pieces may break off and travel through the air at great speed. |
| | 2.2 Always use the appropriate size and type punch. |
| | 2.3 Always use the appropriate size hammer. |
| | 2.4 Don't try to use a center punch on very hard material. |
| | 2.5 Use care not to bend pin and aligning punches. |

Section 5: Sharpening a center punch.

NOTE: These general procedures can be adapted to care for other types of punches.

Steps

Key Points

SAFETY NOTE: DO YOU HAVE YOUR SAFETY GLASSES ON?

1. Redress the head

- 1.1 After some use, the head of a punch will mushroom out.
 - a. Sharp edges may cut the hand.
 - b. Pieces may break off and fly through the air with great speed.
- 1.2 Break off all loose metal.
- 1.3 Using a power grinder, square the head with the shank. A slightly convex head works well.
- 1.4 Chamfer the edge of the head slightly at about a 20 degree angle to prevent chipping of the edge. This angled portion is called the crown radius.

2. Reshape the point.

- 2.1 Place the center punch between the thumb and forefinger of the left hand.
- 2.2 Hold the center punch at a 30 degree angle to give a 60 degree point.
- 2.3 Rest the forefinger against the tool rest.
- 2.4 Grind the tip of the punch. Be sure to maintain the proper angle.

NOTE: The angle of the point on a center punch may vary according to the hardness of the metal to be cut.

- a. Use light steady pressure.
- b. Use a medium or fine grinding wheel.
- c. Cool the punch frequently to keep the tip from being annealed.

3. Test the punch.

d. Check the angle of the tip frequently with a tool gauge.

3.1 Test the center punch by using it on a piece of scrap metal.

Section 5 Materials Needed:

1. Safety glasses
2. Power grinder with a medium to fine wheel.
3. Container of water for cooling.
4. Hammer
5. Material for testing center punch.
6. Tool gauge.
7. Center punches to be sharpened.

References:

Fundamentals of Service-Shop Tools, Deere and Company, 1973, pp.13-14.

Shinn, Glen C., and Weston, Curtis R., Working in Agricultural Mechanics, McGraw-Hill Book Co., 1978, pp.259-260.

Section 6: How Do You Sharpen a Twist Drill?

Questions

1. What is a twist drill used for?
2. What are the three principle parts of a twist drill?

Discussion

- 1.1 A twist drill is usually used to drill holes in metal. It can also be used to enlarge previously drilled holes or drill holes in other materials such as wood or plastic.
- 2.1 Shank-- The part of the drill that fits into the driving mechanism. The shape of the shank varies

according to the driving mechanism use. Common shapes include:

- a. Bit stock--fits into the chuck on a bit brace
 - b. Straight shank--fits chucks commonly used on small drill presses and hand electric drills
 - c. Taper shank--the shank usually has a standard morse taper that is used in larger drill presses and machine tools.
 - d. Blacksmith shank--straight round shank with a flat side.
- 2.2 Body--the body of a twist drill contains channels called flutes that carry metal cuttings away and provide a way for lubrication to get to the point. Drills used in general work usually have two flutes.
- 2.3 Point--the cutting takes place at the point. Several definitions are associated with the point.
- a. Dead center--The center of the tip.
 - b. Lip(cutting edge)--does the cutting. Lips may be ground to different angles depending on the material to be drilled. For general shop use the lips are ground to an angle of 59 degrees with the centerline of the bit.
 - c. Heel clearance--the contour angle behind the cutting edge. This clearance should form a 12 degree angle with the cutting lip to allow clearance for the lip to cut.
 - d. Chisel point--digs into the material being drilled. The chisel point should form a 135 degree angle with the cutting lips.

3. What are twist drills made from?

- 3.1 There are two types of material generally used in twist drills.
- a. Carbon steel--a hard steel, but will lose its temper if overheated.
 - b. High speed tool steel--will resist a degree of overheating.

NOTE: IT IS ESSENTIAL THAT THE DRILL BIT BE KEPT COOL AT ALL TIMES.

4. What should you use to keep a drill bit cool while drilling?

- 4.1 The type of coolant used depends on the material being drilled.
- 4.2 If the recommended lubricant is not available, a straight mineral oil is generally adequate.
- 4.3 Cast iron is generally drilled dry.

NOTE TO THE INSTRUCTOR: If you are going to allow the students to use a drill press to test their drill bits, you may want to include a section on drill press safety in this lesson. A list of drill press safety precautions is included for reference.

5. In what sizes can drill bits be purchased?

- 5.1 Sizes for twist drills are designated by letters, numbers, or fractions.
- a. Numbers--80 to 1--range from 0.0135" to 0.228"
 - b. Letters--A to Z--range from 0.234" to 0.413" respectively.
 - c. Fractions--1/64" to about 3" by 64ths.
- 5.2 For general use, a drill set (index) that contains drill bits from 1/64" to 1/2" by 64ths may be adequate.

Section 6: Sharpening a Twist Drill

<u>Steps</u>	<u>Key Points</u>
1. Position the twist drill for grinding.	1.1 Place the forefinger of the left hand on the tool rest and press the flute firmly against the finger with the thumb. 1.2 Hold the drill at an angle of 59 degrees to the face of the drill parallel to the tool rest. 1.3 Be careful not to touch the wheel to the stone until you are ready to grind.
2. Grind one lip.	2.1 Turn the grinder on with the right hand. 2.2 Grasp the shank of the bit with the right hand. 2.3 Gently but firmly, push the drill into the stone to begin grinding. 2.4 While grinding, lower the shank in the right hand to produce a short sweeping motion. With practice, this will produce the correct heel clearance. 2.5 Use care not to twist the bit while grinding.
3. Keep the bit cool.	3.1 Cool the bit in water every 5. or 6 strokes. 3.2 When cooling the bit, do not release the left hand, this will allow you to return the bit to the same position on the tool rest.
<u>SAFETY NOTE:</u> SAFETY GLASSES!!!	
4. Grind the other lip.	4.1 When one lip is ground, turn the bit over and grind the other lip. 4.2 Use care to position the bit exactly the same in the left hand.
5. Check the drill.	5.1 Examine the drill bit to see that both cutting edges are exactly the same length.

- 5.2 Check the chisel point angle
It should be close to 135 degrees.
- 5.3 With a tool gauge, check the cutting edge angles. They should both be 59 degrees.
- 5.4 Check the clearance angle.
It should be about 12 degrees. If using a tool gauge that measures the clearance angle in inches, the following values will give an angle of about 12 degrees:
1/4" drill--1/32" drop
1/2" drill--1/16" drop
3/4" drill--3/32" drop
1" drill-- 1/8" drop
6. Test the drill.
 - 6.1 Test the drill by drilling a sample of the material for which the drill is ground.
 - 6.2 The drill should cut easily, producing cuttings from both lips.
 - 6.3 The drilled hole should be smooth and round.

Section 6 Materials Needed:

1. Safety glasses
2. Power grinder with a medium to fine wheel.
3. Container of water for cooling
4. Drill bits to be ground
5. Drill press for testing drills
6. Material for testing drill bits.
7. Tool gauge

References:

Shinn-Weston, Working in Agricultural Mechanics, pp.250-252, 130-139.

Fundamentals of Service-Shop Tools, pp. 17-18.

New American Machinests Handbook, pp.2-2 to 2-36.

Phipps-Mechanics in Agriculture, pp. 135-138,105-112.

Wakeman-The Farm Shop, pp.98-101, 51-52.

Section 7: How Do You Sharpen an Auger Bit?

Questions

Discussion

- | | |
|--|--|
| 1. What is an auger bit used for? | 1.1 An auger bit is usually used with a hand brace to drill holes in wood. |
| 2. How do you tell what size an auger bit is? | 2.1 Auger bits are usually marked with a number.
2.2 The number on the auger bit gives the diameter of the bit in sixteenths a number 4 bit would be 4/16" or 1/4" in diameter. |
| 3. What is an auger bit set? | 3.1 There are generally 13 auger bits in a set ranging from a No. 4 to a No. 16. |
| 4. What are the parts of an auger bit? | 4.1 The parts of an auger bit are:
a. Feed screw--advances the bit through the wood. A coarse-thread feed screw is for soft woods and a fine-thread feed screw is for hard woods.
b. Spurs--cut the grain of the wood in the proper diameter.
c. Cutting edges--cut the wood.
d. Twist--like the flutes of a twist drill, carry away the wood chips.
e. Shank--has a tang on the end to fit into the chuck of the hand brace. The size number is usually found on the tang. |
| 5. How do you drill a hole with a hand brace and an auger bit? | 5.1 Insert the tang of the bit into the chuck of brace and tighten the chuck firmly.
5.2 If the brace has a ratchet, set it to drive in a clockwise direction. |

6. What other tools can you use in a hand brace?

- 5.3 Start the bit using only minimum pressure. Let the feed screw do the work.
- 5.4 When the feed screw breaks through, remove the bit from the hole and finish the hole from the other side to avoid splintering the wood.
- 6.1 Some other tools that come with tangs that can be used with a hand brace include:
 - a. Expansion bits--bits that are adjustable to drill various size holes. They are used in much the same way as auger bits.
 - b. Countersinks--used for forming countersink holes for such things as wood screws.
 - c. Screwdriver bits--handy for driving wood screws/

Section 7: Sharpening Auger Bits

Steps

Key Points

- | | |
|--|--|
| 1. When should you sharpen an auger bit? | 1.1 When the spurs are bent. |
| | 1.2 When the spurs are dull or nicked. |
| | 1.3 When the cutting lips are dull or nicked. |
| 2. Straighten the spurs. | 2.1 Hold the bit flat on a |
| | 2.2 The diameter of the spurs can be dressed with a flat file. |
| 3. Position the bit in a vise | 3.1 Protect the shank by clamping it between two soft pine blocks. |
| | 3.2 Clamp the shank in a vise. |
| 4. Position the file in your hand. | 4.1 A special auger bit file should be used if possible, but a tapered (three corner) file can be used if care is taken. |

- 4.2 Lay the file along the index finger grasping the blunt end in the palm of your hand. This grip allows you to control the file.
5. Sharpen the spurs.
 - 5.1 Place the file against the inside of the spur.--Never sharpen the spur on the outside.
 - 5.2 File the spur using long sweeping motions. Use pressure only on the forward stroke.
 - 5.3 File until the spur is sharp. Use care not to press the file onto the cutting edge.
 - 5.4 Sharpen the other spur.
6. Sharpen the cutting edges.
 - 6.1 Place the flat surface of the file down flush on the cutting edge.
 - 6.2 Sharpen the cutting edge using long sweeping forward strokes.
 - 6.3 Apply pressure to the cutting edge only.
 - 6.4 Be sure to file only the upper edge of the cutting lip. The lip should be filed at approximately a 25 degree angle.
 - 6.5 Sharpen the other cutting edge.
 - 6.6 Use care not to damage the feed screw.
7. Repair the feed screw.
 - 7.1 If the feed screw is damaged, it can be reshaped with a three corner file.
8. Check the auger bit.
 - 8.1 Check the bit by drilling a hole in a block of wood.

Section 7 Materials Needed:

1. Hammer
2. Flat file.
3. Taper (three cornered) file
4. Auger bit file

5. Tool gauge
6. Auger bits to sharpen
7. Pine blocks.
8. Vise
9. Hand (bit) brace
10. Wood for checking bit.

References:

Shinn-Weston, Working in Agricultural Mechanics, pp. 86-89, 250.

Section 8: How Do You Sharpen Tin Snips and Scissors?

NOTE: Most shearing edge tools can be sharpened using the methods outlined below.

SAFETY NOTE: THE CUTTING EDGES WILL BECOME VERY SHARP SO BE CAREFUL!!!!

DON'T FORGET YOUR SAFETY GLASSES!

<u>Steps</u>	<u>Key Points</u>
1. Take the scissors apart.	1.1 Sharpening scissors or tin snips is easier if they can be taken apart.
2. Choose a sharpening method.	2.1 Shearing edge tools can be sharpened by grinding, whetting, or filing. 2.2 The method of sharpening is determined by the hardness of the shearing tool.
3. Maintain the cutting angle.	3.1 Be sure to maintain the original angle of the cutting edge when sharpening shearing edge tools.
4. Grinding	4.1 Hold the tool on the tool rest at the proper angle to the wheel.(overhead)

- 4.2 Starting at the point, move the blade across the wheel applying a light even pressure. Be sure to move across the entire length of the blade in one stroke.
- 4.3 Inspect for sharpness and bevel at the end of each stroke.
- 4.4 Do not allow the blade to become hot.
- 4.5 Grind the other blade.
- 4.6 Remove the wire edge by whetting. Do not close the blades before removing the wire edge.

5. Whetting

- 5.1 Whetting can be used to remove a wire edge or to sharpen edges that are not overly dull or damaged.
- 5.2 Hold the blade on the stone at the correct angle. Start near the pivot of the blade.
- 5.3 Whet with a forward stroke diagonally across the cutting edge, being sure to maintain the correct angle.
- 5.4 For large blades, clamp the blade in a vise and move the stone across the blade.
- 5.5 Be sure to keep the stone clean and well oiled.
- 5.6 Remove the wire edge by placing the inside of the blade flat on the stone and whetting just enough to remove the wire edge.

6. Filing

- 6.1 If the blades are not too hard, they can be sharpened with a smooth mill file.
- 6.2 Clamp the blade in a vise.
- 6.3 There are two methods of filing:
 - a. Draw filing--draw file from the point to the pivot. Be sure to maintain the original angle.
 - b. Diagonally--angle the file diagonally toward the point. Start at the pivot and file the entire length of the

cutting edge with one stroke. Be sure to maintain the original angle.

- 6.4 Remove the wire edge by whetting with an oilstone.
- 7. Reassemble the shears.
- 7.1 If the shears were taken apart, reassemble them taking care to tighten the pivot screw properly. The blades should feel firm but not tight.

Section 8 Materials Needed:

- 1. Shearing edge tools to sharpen
- 2. Oilstone
- 3. Oil for the oilstone
- 4. Cleaning rags
- 5. Smooth mill file
- 6. Tools necessary to take shears apart
- 7. Vise
- 8. Grinder with medium or smooth wheel
- 9. Safety glasses

References:

Phipps, Mechanics in Agriculture, pg. 140.

Wakeman, The Farm Shop, pg. 56.

Jones, Shopwork on the Farm, pp. 233-234.

Tryout:

- 1. Students will sharpen those tools that are covered.
- 2. Encourage students to bring tools from home to sharpen.

Followup:

1. Students will be graded on tool sharpening.
2. Material from this lesson will be covered on quizzes and on the unit test.

Materials:

Materials needed are listed in the individual sections.

References:

References are listed in the individual sections.

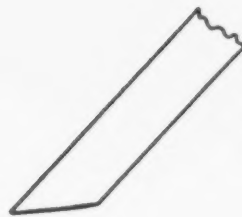
GRINDING A PLANE IRON

GRIND:

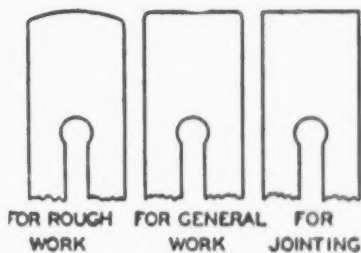
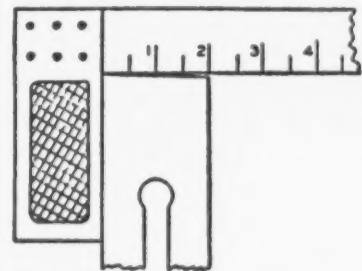
① WHEN EDGE IS NICKED,—



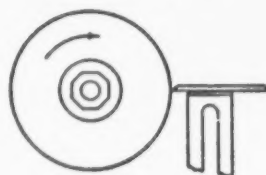
② WHEN CONCAVE BEVEL HAS BEEN REMOVED BY WHETTING,—



③ WHEN EDGE IS NOT SQUARE.



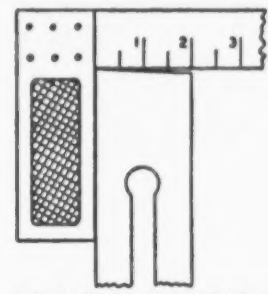
④ SHAPE OF CUTTING EDGE



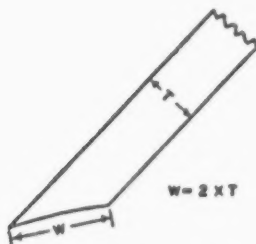
⑤ FOR JOINTING:
PLACE IRON AT LEVEL
OF CENTER OF STONE,—



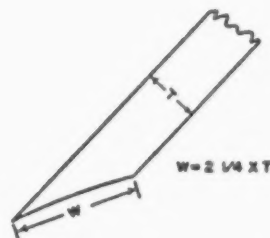
MOVE IRON
RIGHT & LEFT,—



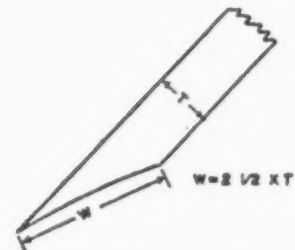
TEST EDGE FREQUENTLY
FOR SQUARENESS.



⑥ USE BLUNT BEVEL FOR VERY
HARD WOOD,—



⑦ MEDIUM BEVEL FOR MOST
WOODS,—

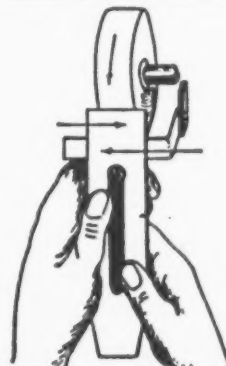


⑧ AND A LONG BEVEL FOR VERY
SOFT WOOD.

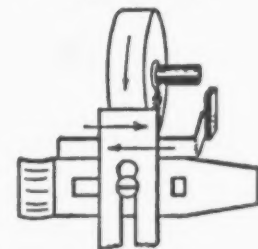


GRIND THE BEVEL WITH
GRINDER TURNING TO-
WARD CUTTING EDGE BY
MOVING IRON RIGHT &
LEFT.

⑨



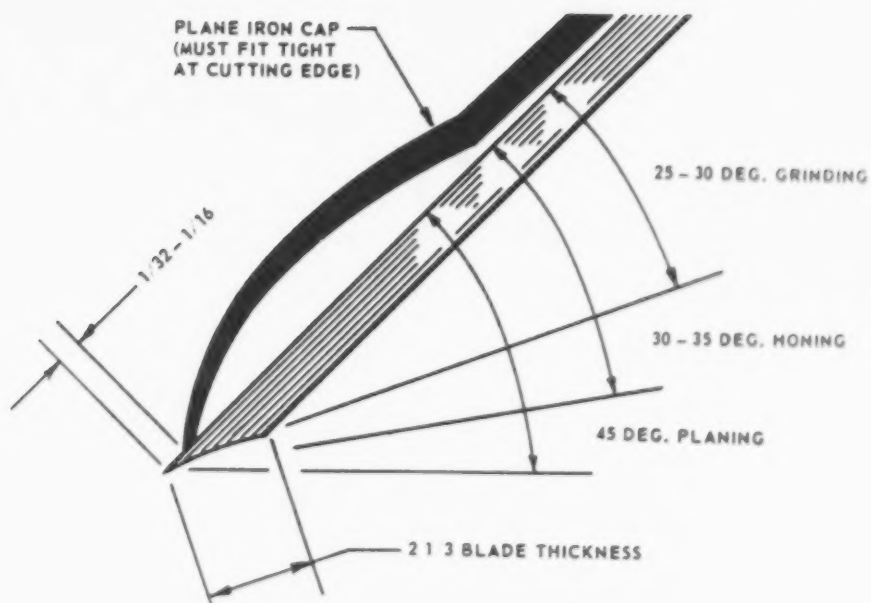
A SUGGESTION



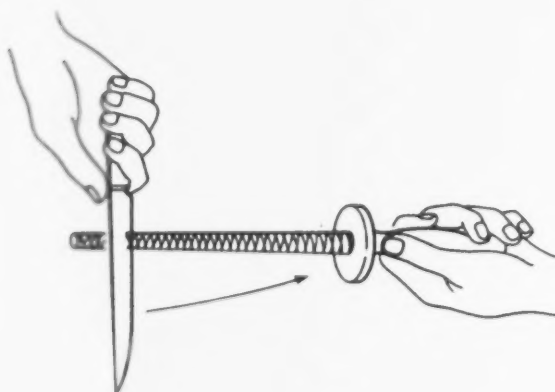
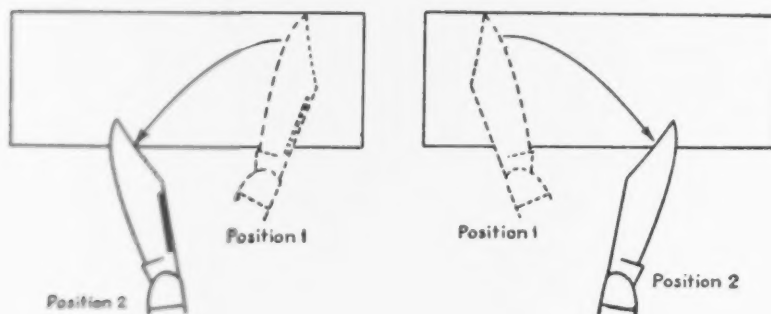
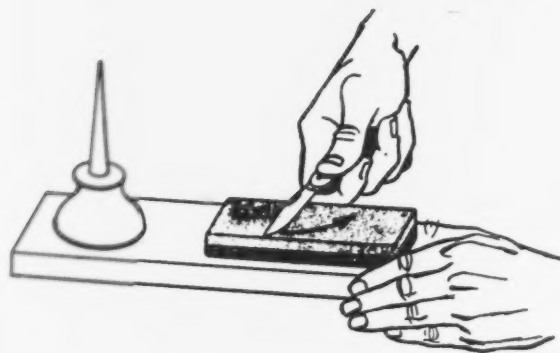
USE PLANE IRON CAP
AS GUIDE.

⑩

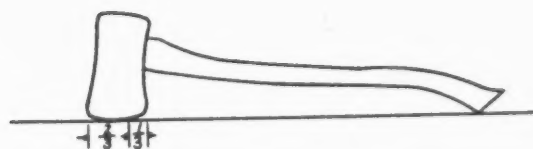
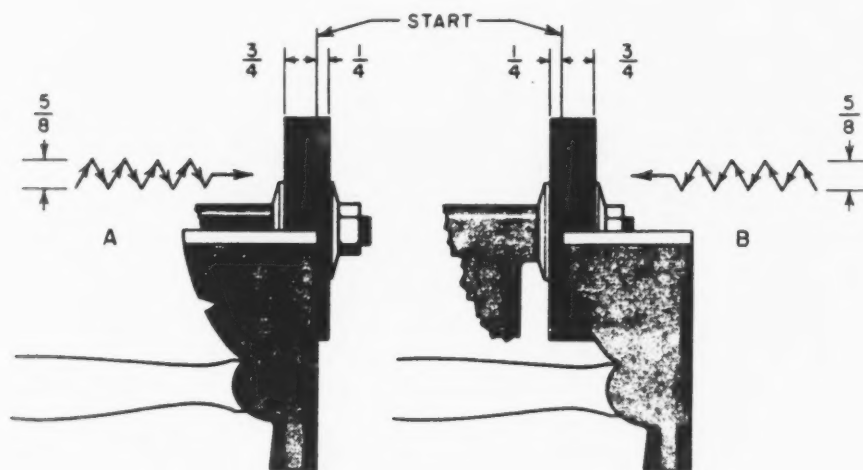
GRINDING AND HONING ANGLES FOR A PLANE IRON



KNIFE SHARPENING



SHARPENING AXES AND HATCHETS



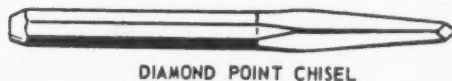
COLD CHISELS



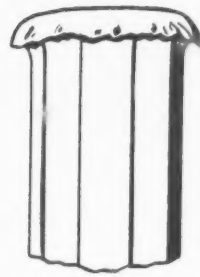
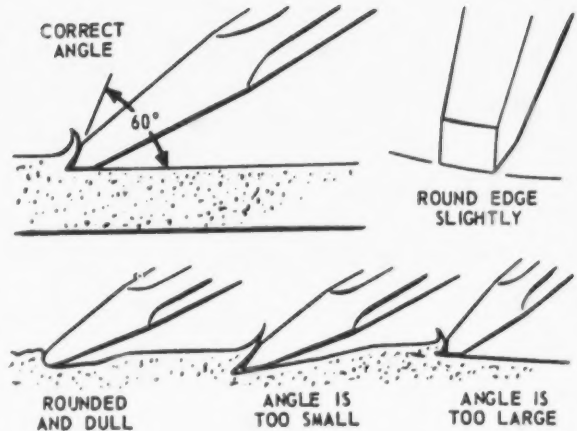
CAPE CHISEL



ROUND NOSE CHISEL



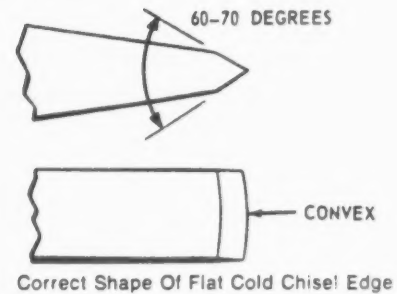
DIAMOND POINT CHISEL



WRONG



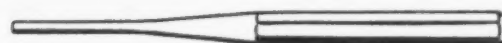
RIGHT



PUNCHES



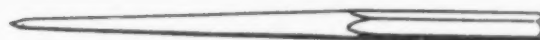
STARTING PUNCH



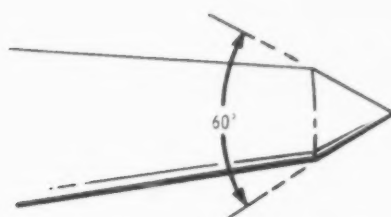
PIN PUNCH



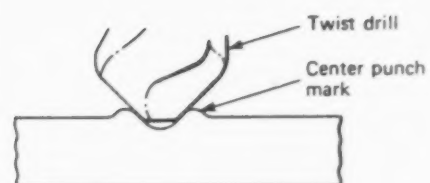
CENTER PUNCH



ALIGNING PUNCH



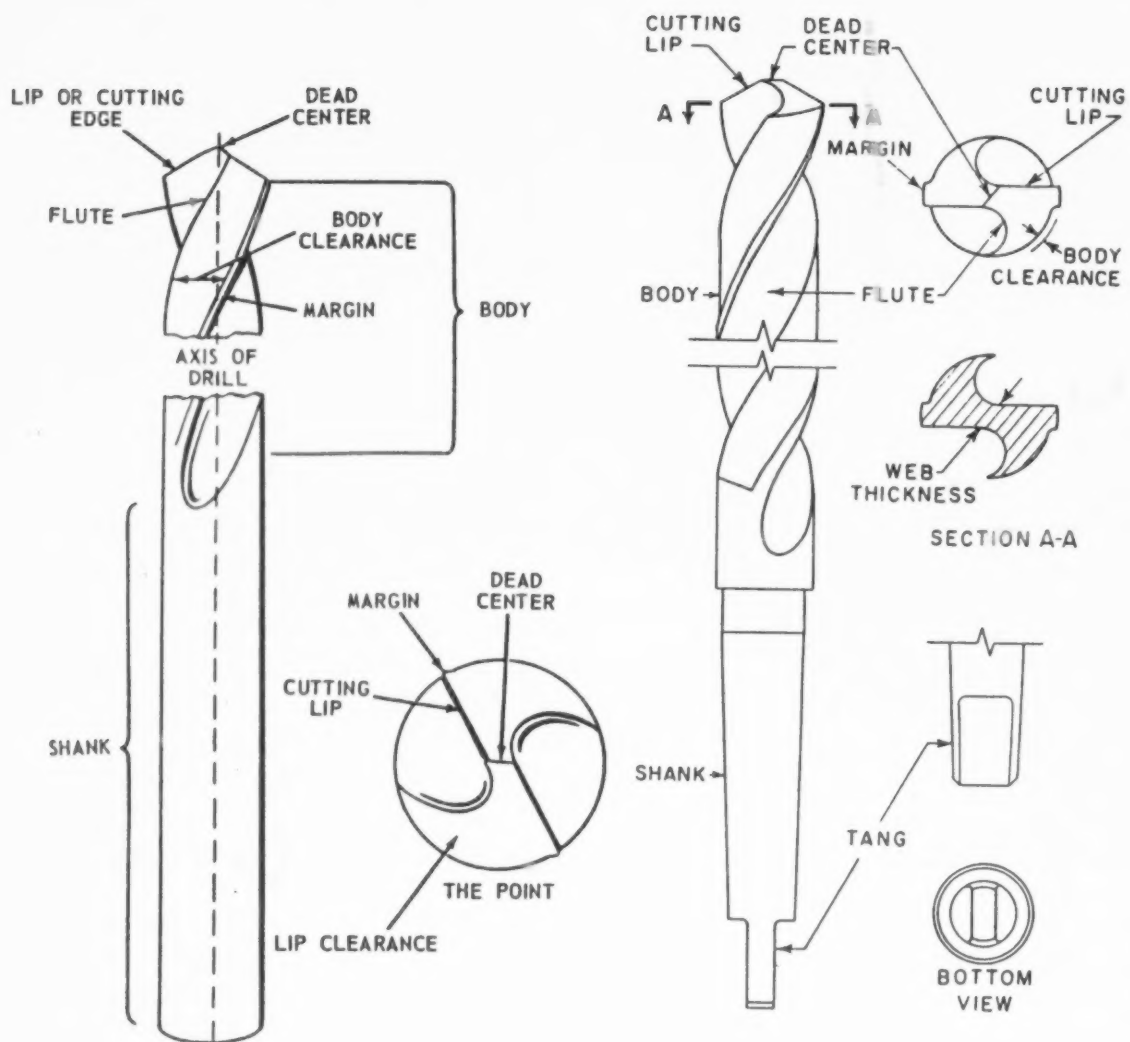
— Correct Angle For Point Of Center Punch



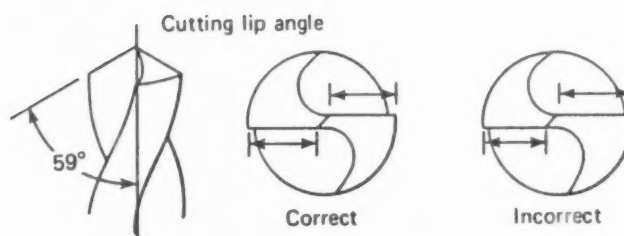
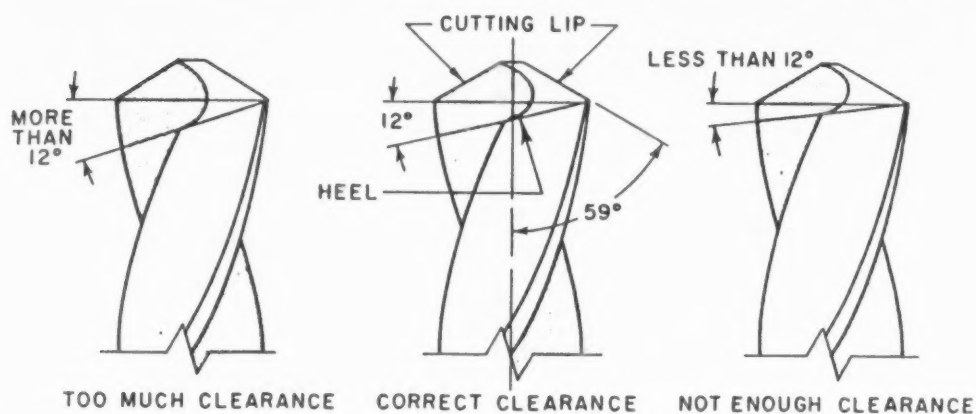
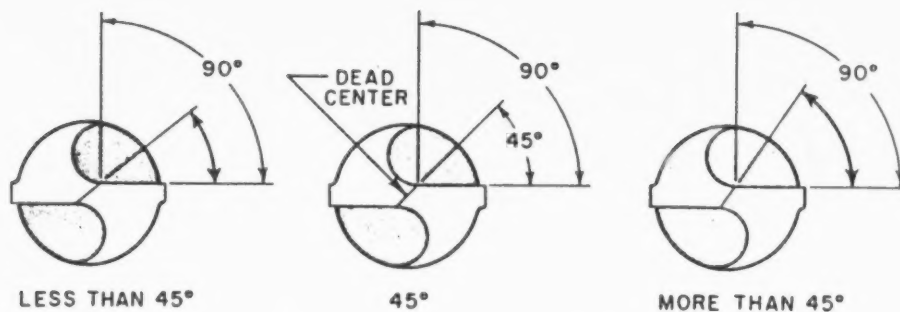
Twist drill

Center punch mark

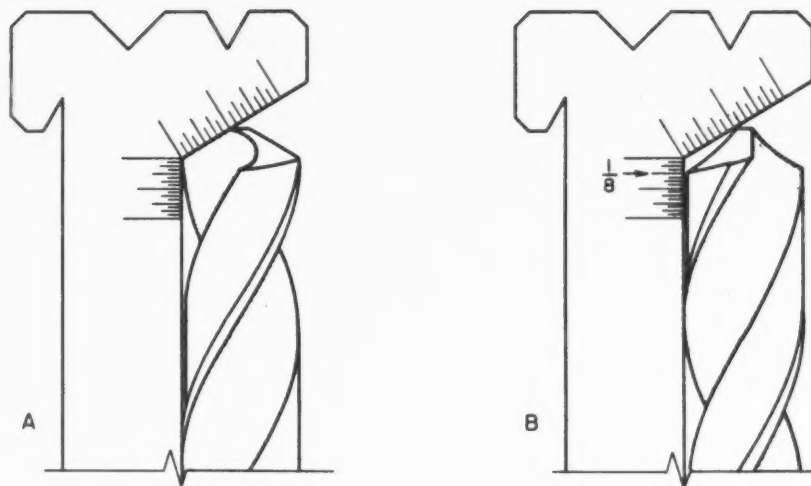
TWIST DRILLS



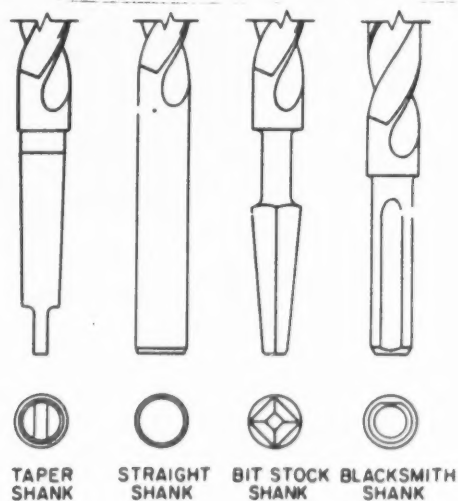
SHARPENING TWIST DRILLS



TWIST DRILLS

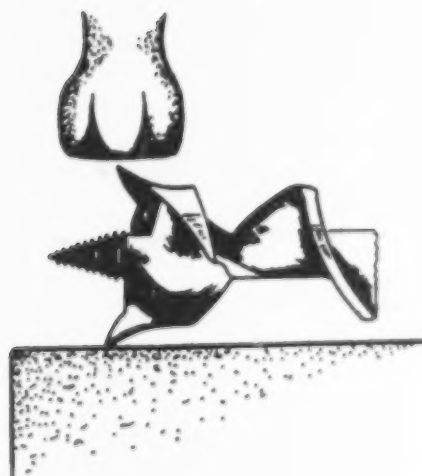
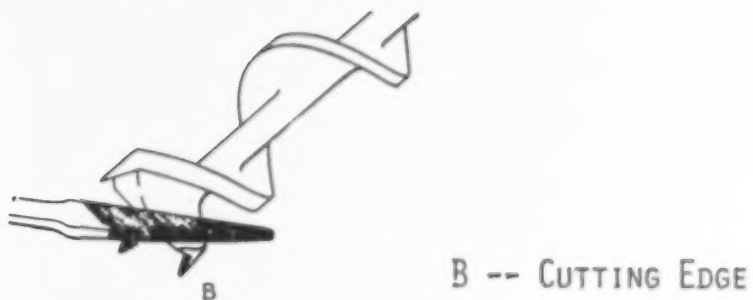
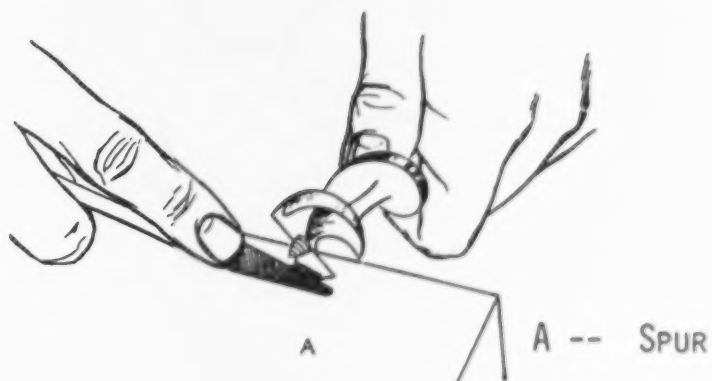


CHECKING THE SHAPE OF THE POINT OF A TWIST DRILL (A)
CHECKING THE CLEARANCE OF A TWIST DRILL (B)



SHAPES OF TWIST-DRILL SHANKS

SHARPENING AN AUGER BIT

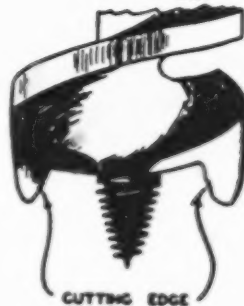


SHARPEN AN AUGER BIT



SHARPEN WHEN SPURS ARE BENT—

①



WHEN SPURS ARE DULL OR NICKED—

②



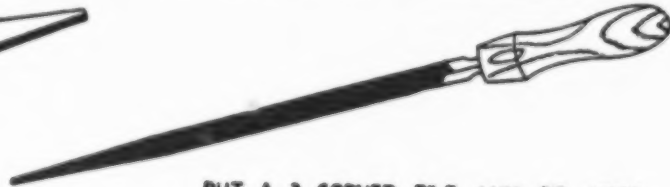
OR WHEN CUTTING LIPS ARE DULL OR NICKED.

③

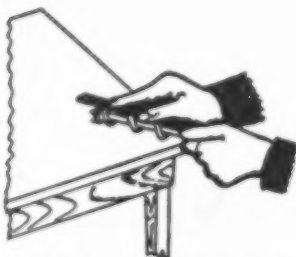


AUGER BIT FILE SHOULD BE USED ON ALL SIZE BITS—

④



BUT A 3 CORNER FILE MAY BE USED ON LARGER BITS.



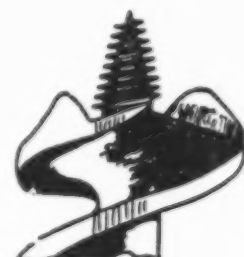
IF SPURS ARE BENT OUTWARD FILE LIGHTLY WITH FLAT FILE UNTIL DIAMETER AND SPURS ARE EQUAL. KEEP FILE FLAT.

⑤



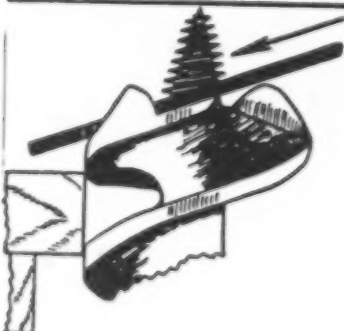
FILE CUTTING EDGE OF SPURS ON INSIDE. FILE TOWARD CUTTING EDGE.

⑥



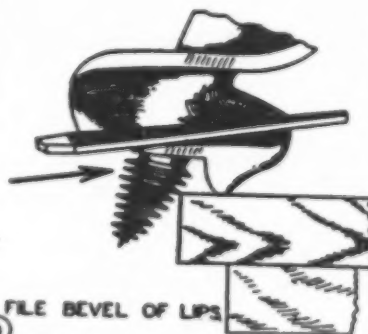
NOTE— CUTTING EDGE OF LIP SHAPED LIKE A CHISEL— ONE SIDE FLAT ONE SIDE BEVELED.

⑦



FILE FLAT SIDE OF LIPS.

⑧



FILE BEVEL OF LIPS

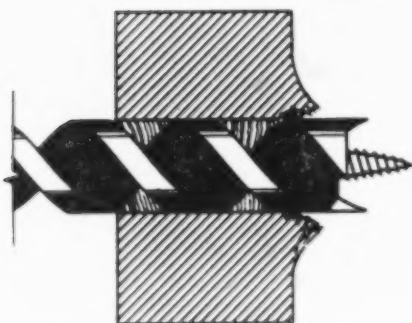
⑨



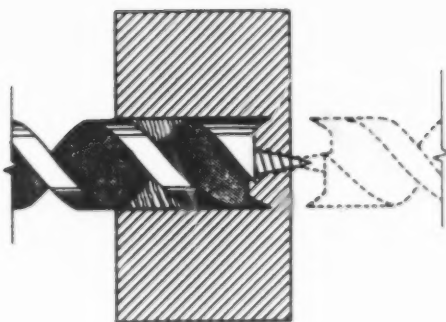
RUN 3 CORNERED FILE AROUND THREADS OF FEED SCREW IF DAMAGED.

⑩

FINISHING A HOLE WITH AN AUGER BIT

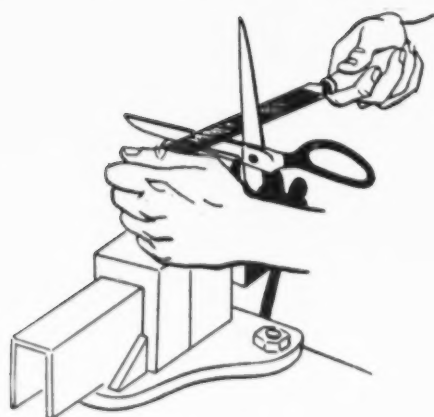


WRONG

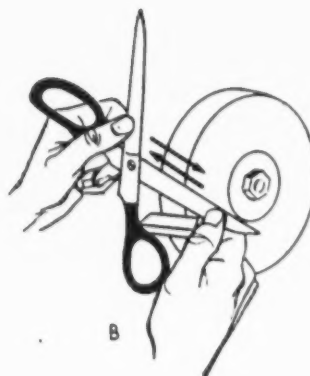


RIGHT

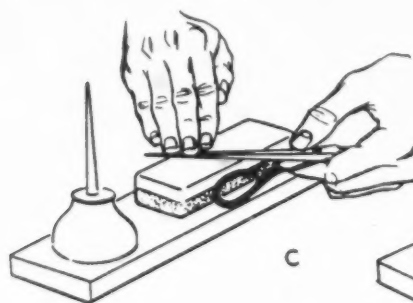
SHARPENING SCISSORS



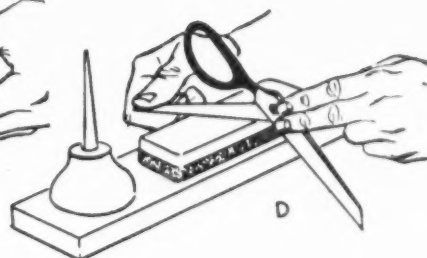
A



B



C



D

A-- FILING

B-- GRINDING

C-- WHETTING

D-- WHETTING

TASK OPERATION SHEET

Unit: Tool Conditioning

Lesson: Sharpening a Plane Iron

Steps	Standard Procedure and Specifications	Safety and Key Points
1. Gather Equipment needed.	a. Proper grinding wheel, plane iron, goggles, water, oilstone, tool gauge, and try square.	a. Use medium fine grit of about 80 and a soft grade wheel.
2. Remove and examine plane iron.	a. Remove plane iron and cap iron from plane. Loosen cap iron screw and slip screw through hole in plane iron slot. b. If plane iron has nicks, gouges, or scratches, it needs to be ground.	a. Be sure to remove cap iron before sharpening. b. Using gauge, check the bevel. c. Bevel should be 25° to 30°.
3. Remove nicks and scratches from plane iron	a. Place plane iron flat on tool rest with cutting edge pushed slightly against grinding wheel b. Move plane iron from left to right until cutting edge is ground square with side of plane iron and all nicks and scratches removed. c. Using a try square, check the squareness of the plane iron.	a. Take off as little edge as necessary. b. Dip iron frequently in water to keep it cool.
4. Replace cap iron	a. Put cap iron on beveled side of plane iron with square end toward cutting edge. This will keep cutting edge square.	a. Be sure cap iron is square with plane iron.
5. Align plane iron on wheel	a. Place square end of cap iron against outer edge of tool rest. Slide plane iron forward until it comes in contact with grinding wheel at a 25° angle—hold plane iron firmly in right hand and tighten down cap iron screw.	

Steps	Standard Procedure and Specifications	Safety and Key Points
6 Grinding	a. Move iron from left of right, holding square end of cap firmly against tool rest. b. Stop stroke when back edge of iron passes beyond the edge of grinding wheel about 1/3 width of wheel. c. Continue to grind until wire edge appears across cutting edge	a. Cool iron frequently with water. b. Hold iron firmly enough to have good control. "Do not let the grind-wheel control you".
7. Whetting with an oilstone	a. Place plane iron flat side down on the stone with the cutting edge making a slight angle with the edge of the stone, and push it forward. b. If a wire edge appears on beveled side, then turn plane iron over and whet the beveled side. Keep bevel flat on stone or raise heel of iron very slightly. c. To finish, turn iron over again to flat side and whet to put the fine edge on iron.	a. Keep tool perfectly flat against the stone. b. Use very light pressure when whetting beveled side. Keep hands parallel to stone. c. Keep iron perfectly flat on stone. Make smooth motions as 7a. d. Place a few drops of oil on the oilstone before whetting.

TASK OPERATION SHEET

Unit: Tool Fitting

Lesson: Sharpening a Wood Chisel

Steps	Standard Procedure And Specification	Safety and Key Points
1. Gather Equipment	a. Goggles, chisel, tool gauge, water container oil stone	a. Make certain the grind-wheel is true.
2. Examine the wood chisel	a. Using a tool gauge, check the angle of the bevel. b. Using a try square check the squareness of the chisel point.	a. Wood chisels should have a bevel of 25° to 30°.
3. Squaring the wood chisel.	a. Place horizontally on the tool rest with the bevel side down. b. Move the chisel forward into the grinding wheel. c. Move the chisel right to left against the grinding wheel until the cutting edge is square to the sides and the nicks have been removed. d. Check squareness with a small try square.	a. Do not apply too much pressure and cool frequently to avoid loss of temper.
4. Grinding the bevel of the wood chisel	a. Hold the wood chisel between the left forefinger and thumb. b. Place the forefinger against the outside edge of the tool rest. c. Push the chisel forward, and at the same time, lower the handle until the proper angle (25° to 30°) is established. d. Move the chisel across the face of the wheel from left to right. Use right hand to apply pressure. e. Grind bevel until a wire edge appears.	a. Always return to the same position when grinding. b. Cool frequently c. Check bevel frequently.

Steps	Standard Procedure and specifications	Safety and Key Points
5. Remove wire edge	a. Place the wood chisel flat side down, on the oilstone. With the cutting edge make a slight angle with edge of stone, push forward.	a. Keep chisel perfectly flat against stone.
6. Whet the wood chisel.	a. Place the wood chisel on the oilstone with heel and toe of bevel in contact with the stone. b. Whet the wood chisel either with the back and forth motion or a figure eight motion. c. Continue whetting until cutting edge is sharp.	b. Keep bevel flat against stone.

TASK OPERATION SHEET

Task: Sharpening Auger Bits

STEPS	PROCEDURE	SAFETY & KEY POINTS
1. Assemble materials	a. Auger bit b. Bit file c. Vise d. Two small pieces of wood e. Safety glasses	d. Soft pine wood block is best
2. Position bit in vise	a. Use vise to hold bit b. Place two pieces of wood on both sides of the shank when gripping bit tight in the vise	a. Place the shank or shaft in the vise as this will allow better working room on the spur & cutting edge b. The blocks of wood prevent the shank from being scored
3. Position file in hand	a. Lay the file along the index finger grasping the blunt end in the palm of your hand	a. It is best not to grasp the file in a plain grip as you don't have the control of the file needed
4. Sharpen spur	a. Place the file against the <u>inside</u> of the spur (flush) b. Place the edge of the file flush against the cutting edge c. Use long sweeping movements forward d. Put pressure against the spur and file until all bluntness is gone	a. Don't sharpen on outside b. Do not angle the file against the spur c. Never come backward with the file against the spur d. Don't put any pressure down against the cutting edge. This will cause a groove in the cutting edge
5. Sharpen cutting edge	a. Place the flat surface of the file down flush on the cutting edge b. Use long sweeping forward strokes c. Apply pressure to the cutting edge only d. File until all bluntness is gone from the cutting edge	b. Never come back on the cutting edge with the file
6. Sharpen other side	a. Rotate bit and repeat steps 2-5	
7. Test bit	a. Put the bit in a brace and drill a hole in a block of wood	a. The shavings should curl evenly from both sides

TASK OPERATION SHEET

Task: Sharpening Cold Chisels

STEPS	PROCEDURE	SAFETY & KEY POINTS
1. Assemble materials	a. Cold Chisel b. Grinder & Water c. Angle guage d. Safety glasses e. Try square	
2. Redress head	a. Break of all loose metal b. Square the head with the shank c. Grind the crown radius	
3. Remove nicks	a. Point edge of cold chisel directly into grinding wheel edge b. Use light pressure and grind until all nicks are gone c. Check squareness with a try square	
4. Position cold chisel in hand	a. Grasp firmly in one hand with first finger against tool rest so the chisel will be at an angle of 65° - 70° (see below)	a. Have a firm grasp on the chisel
5. Start grinding	a. With your other hand grasp the head of the chisel b. Press cutting edge of chisel against wheel by lifting up the chisel head c. Move chisel head sideways across the face of the wheel d. Turn over and repeat	a. Don't apply too much pressure b. Dip in water occasionally to cool
6. Obtain correct angle	a. With angle guage check the cutting edge angle b. Use try square to determine if cutting lip is square.	a. Angle of 65° to 70° for general purpose work
7. Finish grinding	a. Grind both sides so that the cutting edge is in the center of the cold chisel	
8. Test	a. Test by cutting a piece of sheet metal or rod	a. Cutting should be smooth and easily done

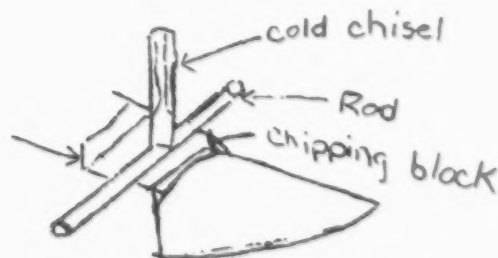


TASK OPERATION SHEET

Task: Use of Cold Chisel (Cutting rod)

Steps	Standard Operation and Procedures	Safety & Key Points
1. Gather equipment.	1. Cold chisel, bell peen, or blacksmith hammer, vise grip pliers.	
2. Mark rod.	1. With marking awl or scriber, mark off proper length rod.	a. Make accurate measurement to avoid waste.
3. Nick rod	1. Lay rod on clipping block of an anvil. 2. Lay rod crosswise with the anvil. 3. Place cutting edge of a properly sharpened cold chisel on the mark. 4. Hit cold chisel with a hammer using the proper sized blows for the work being performed. 5. Nick rod about 1/3 through; turn rod over and nick other side properly.	a. Keep rod laying flat. b. If rod is quite long, use some means of supporting it. c. A properly sharpened chisel should be beveled at 65 to 70 degrees. d. Use hammer of proper size for work being done. e. If cutting heavy rod, nick on all four sides.
4. Break rod.	1. Place rod in vice so nicked and protrudes over jaws of vice. 2. Bend back and forth until rod is broken.	a. Avoid having rod protruding too far beyond edge of the vice jaws.

NOTE:



Rod Properly Nicked

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 5: What is the Difference Between a Crosscut Saw and a Rip Saw?

Estimated Time Required: One or two periods.

Need For Lesson:

Handsaws are still very important in the shop today. The ability to select, use and care for handsaws is basic to any type of woodworking. A properly sharpened properly cared for handsaw will last for many, many years.

Objectives:

Upon completion of this lesson, students should be able to:

1. Select the proper handsaw for a specific job.
2. Properly use a handsaw.
3. Properly sharpen a handsaw.

Motivation:

Allow the students to try to cut across the grain with a rip saw and with the grain with a crosscut saw. Then allow the students to try the crosscut saw and have them discuss any difference they may have noticed.

Presentation:

It may be difficult to obtain enough handsaws for the students to sharpen. A simple project can be made to allow the students to learn the basics of saw sharpening and to clearly illustrate the difference between a crosscut saw and a rip saw.

Give the students a piece of sheet metal about the thickness of a saw blade and let them lay out and file to shape several saw teeth. If the proper thickness material is used, a saw set can be used to set the teeth. The project can be graded on such things as layout, uniformity of teeth, and correctness of angles.

Questions

1. What are some types of hand saws?
2. What is the difference between a crosscut saw and a rip saw?
3. What is the difference in the use of the two types of saws?
4. What are some things to consider when using a hand saw?

Discussion

- 1.1 Rip saw--used for cutting wood with the grain.
- 1.2 Crosscut saw--used for cutting wood across the grain.(OH-1)
- 1.3 Compass saw--used for sawing curves in wood.
- 1.4 Coping saw--used for sawing curves in light wood. Note that the blade can be inserted either way depending on the intended use.
- 1.5 Back saw--used for fine cutting. The teeth are fine(13 to 16 teeth/inch). The blade is thin and the kerf is narrow. The back is reinforced to help make the blade ridged. A use for a back saw would be for cutting angles on trim with a miter box.
- 2.1 The teeth on a crosscut saw are made to slice across the grain.
- 2.2 The teeth on a rip saw are made to remove chips like a chisel.
- 3.1 The rip saw is held at a 60 degree angle to the board being cut.
- 3.2 The crosscut saw is held at a 45 degree angle to the board being cut.(OH-2,3)
- 4.1 Grip the saw with the forefinger pointing along the side of the handle. This allows better control.
- 4.2 Hold the saw at the correct angle square with the board. For beginners it may be helpful to use a try square to square the blade.

- 4.3 Start the cut by making two or three backstrokes guiding the saw with the thumb of the other hand.
 - 4.4 Remember the kerf is the width of the material being removed. Be sure to consider the kerf when laying out a cut.
 - 4.5 Make the cut using long smooth strokes. Use only light pressure. Use pressure only on the forward stroke.
 - 4.6 Use short light strokes when finishing a cut to avoid splintering the wood.
5. What are the steps used when sharpening a saw?
 - 5.1 Jointing--filing the tips of the teeth square and even. (OH-4)
 - 5.2 Setting--teeth are set or bent to alternating sides of the blade to allow the kerf to be wider than the blade. A saw set is used to set saw teeth. (OH-5)
 - 5.3 Filing--teeth are filed to the correct angle with a tapered file.
 6. What is meant by the number of points?
 - 6.1 The number of tooth points per inch including the beginning and ending point in an inch. A five point saw would have four teeth per inch.
 7. What are the angles filed on saw teeth?
 - 7.1 Angles given will vary among authorities and for different uses so try to maintain the original angle if possible.
 - 7.2 Rip saw--the front of teeth are filed at a 90 degree angle with the tooth line and a front angle of 90 degrees. The backslope angle of the tooth is 60 degrees.

- 7.3 Crosscut saw--the front slope of the teeth are 15 degrees, the front face of the teeth are 15 degrees to the tooth line, and the backslope of the teeth are 45 degrees.

SHARPENING A HANDSAW:

Steps

1. Joint the teeth
2. Setting the teeth.
3. Filing the teeth.

Key Points

- 1.1 Clamp the blade in a vise. If a saw sharpening vise is not available, clamping the blade between two wood blocks will work well.
- 1.2 File the teeth by holding a smooth mill file square over the top of the teeth lengthwise and filing until the teeth are even. A special tool is available for jointing a saw.
- 2.1 Set the saw set to the number of teeth per inch on the saw if it is adjustable.
- 2.2 Using moderate pressure, set every other tooth, reverse sides and set the rest of the teeth.
 - a. Be sure to set the teeth the same as they were originally set.
 - b. Only 1/3 to 1/2 the length of the tooth should be bent when setting.
- 3.1 File only until the shiny edge on top of the teeth caused by jointing disappears. The saw is sharp at this point.
- 3.2 Good lighting is essential.
- 3.3 Use only enough pressure to make the file cut, cut only on the forward stroke.

- 3.4 To prevent screeching, you may want to raise the point of the file slightly.
- 3.5 Set a sliding tee bevel square to the proper angle.
- 3.6 File the teeth that are bent toward you. Use care to maintain the proper angle.
- 3.7 Reverse position and file the other teeth.
- 3.8 If the saw was in very poor shape, it may be necessary to repeat the processes of jointing, setting & filing.
- 4. Touching up
 - 4.1 Some authorities recommend removing the wire edges by rubbing an oilstone lightly on the sides of the teeth.
- 5. Try the saw.
 - 5.1 Try the saw by making a cut. It should cut cleanly with very little pressure.
 - 5.2 A saw that pulls to one side probably is not set the same on each side.

Tryout Experience:

- 1. The students will sharpen a rip and a crosscut saw.
- 2. The students will construct a project that involves making both rip and crosscut saw teeth.
- 3. The students will demonstrate the proper use of both a hand and rip saw.

Followup:

- 1. The saw sharpening projects will be graded.
- 2. Material covered will be included on quizzes and the unit test.

Materials Needed:

- 1. Examples of rip saws, crosscut saws, compass saws, back saws, and coping saws.
- 2. Saws to sharpen.
- 3. Tapered (three corner) files.

4. Smooth mill file for jointing, or a jointing tool.
5. Material for tooth making project if used.
6. Saw set.
7. Sliding tee bevel and framing square for setting angles.
8. Wood to cut.
9. Vise and wood blocks.
10. Overheads 6 and 7.

References:

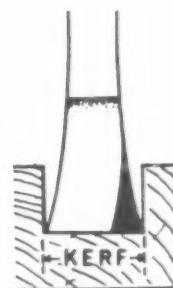
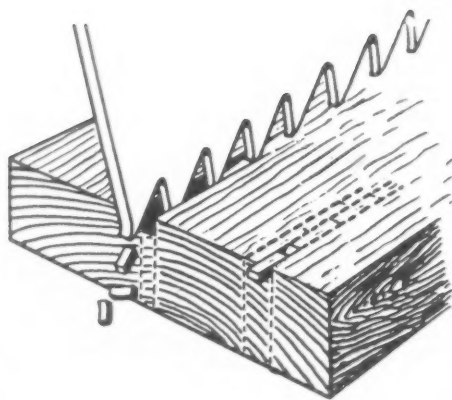
Wagner, Modern Carpentry, pp. 10-11.

Jones, Shopwork on the Farm, pp.235-246, 58-64.

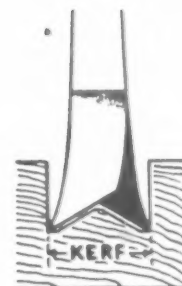
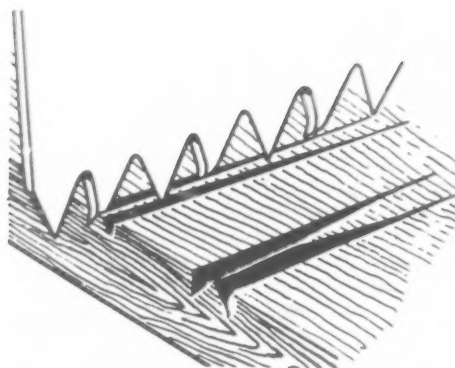
Shinn, Working in Agricultural Mechanics, pp. 80-81.

Wakeman, The Farm Shop, pp. 66-69, 237-242.

HOW HANDSAWS CUT

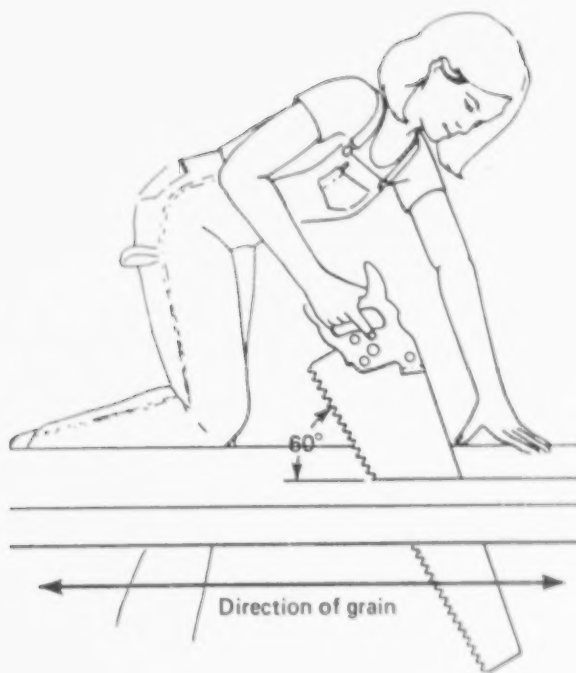


RIP SAW



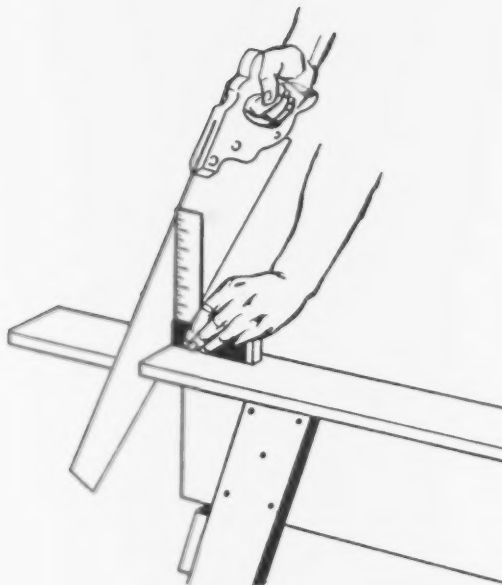
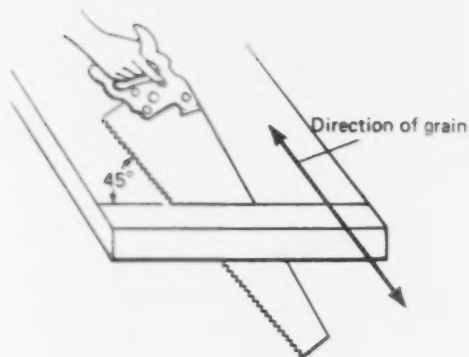
CROSSCUT SAW

HOLD HANDSAW CORRECTLY



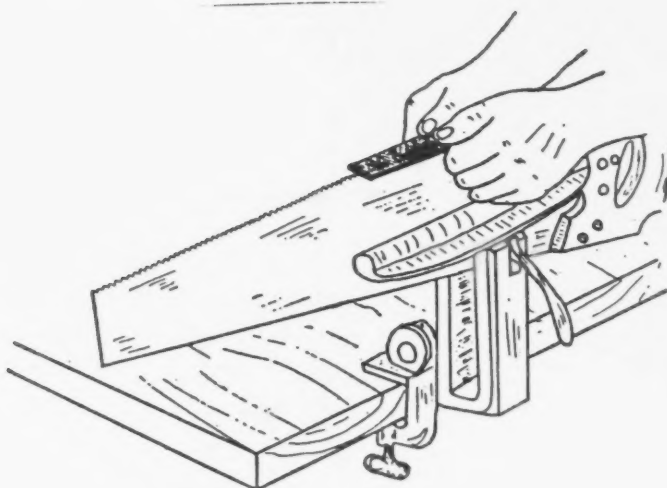
HOLDING THE SAW PROPERLY WILL
IMPROVE YOUR ACCURACY

HOLD HANDSAW CORRECTLY

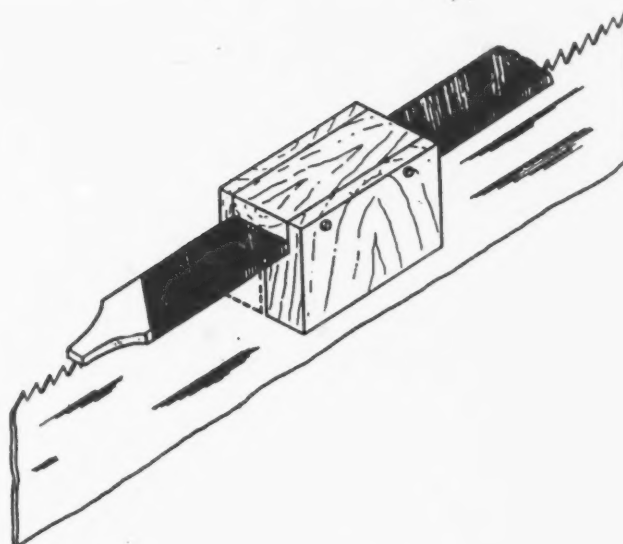


A STRAIGHT START WILL HELP
YOU MAKE A STRAIGHT FINISHED
CUT

JOINTING A HANDSAW

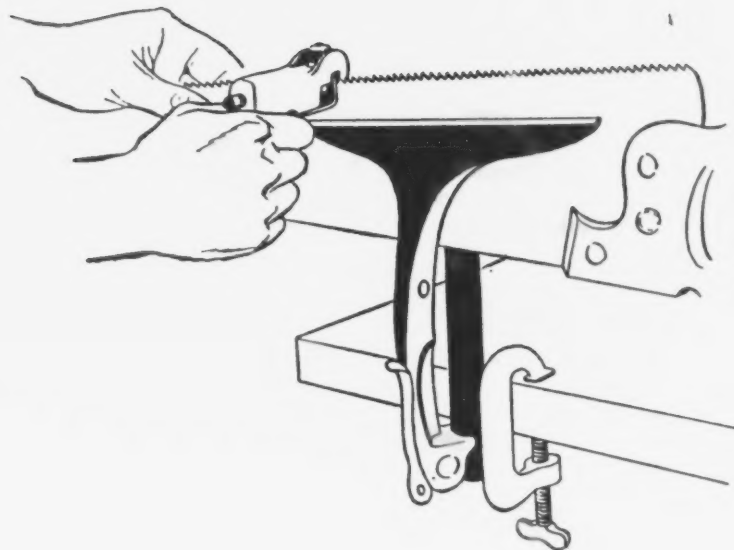


JOINTING WITH A SPECIAL VISE

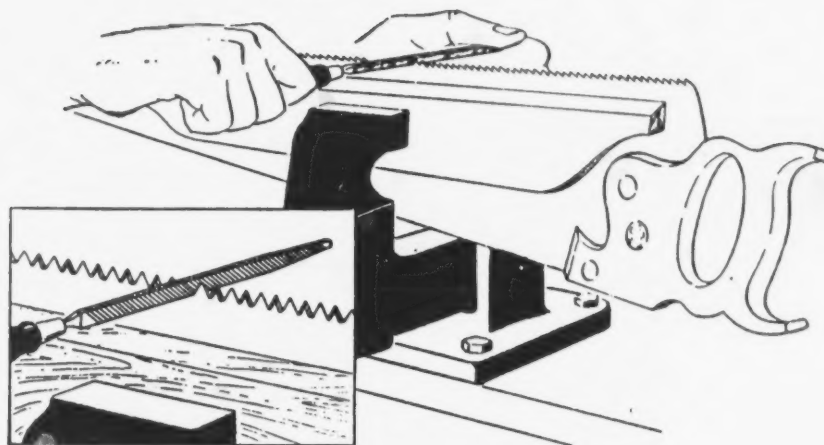


JOINTING WITH A HAND HELD WOOD BLOCK

SAW SHARPENING



SETTING THE SAW TEETH



FILING THE SAW TEETH

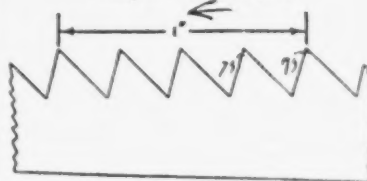
CUTTING CROSSCUT SAW TEETH

WHEN HANDSAW TEETH HAVE BEEN BROKEN OFF GRIND DOWN TO BASE OF TEETH AND CUT NEW TEETH.

SUGGESTION: — BEFORE WORKING ON A GOOD SAW PRACTICE ON AN OLD SAW BLADE OR PIECE OF 12 GAUGE SHEET METAL.

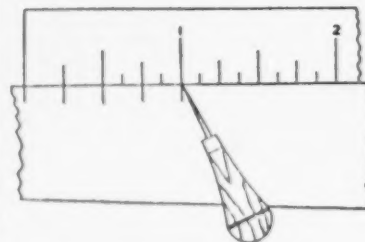
①

5 POINTS PER INCH
4 TEETH PER INCH



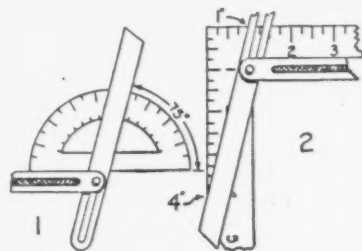
SELECT NUMBER OF POINTS PER INCH WANTED.

②



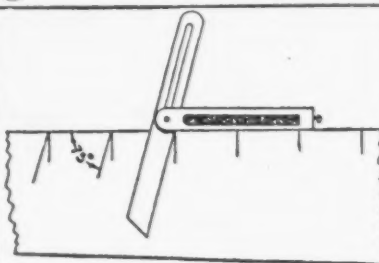
SPACE THE TEETH ACCURATELY.

③



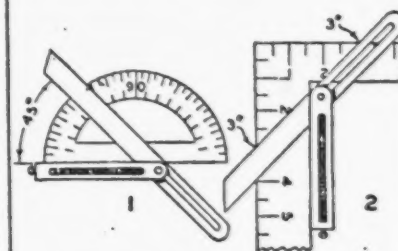
SET T-BEVEL FOR 75°
1. BY USE OF PROTRACTOR.
2. BY USE OF FRAMING SQUARE.

④



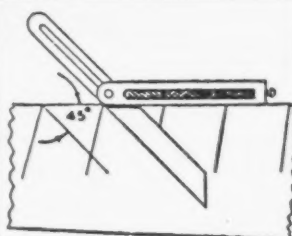
LAY OFF FRONT OF TEETH ON BOTH SIDES.

⑤



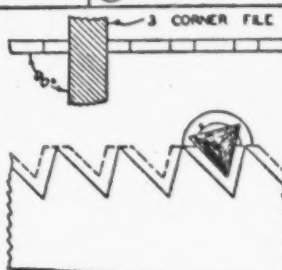
SET T-BEVEL FOR 45°
1. BY USE OF PROTRACTOR
2. BY USE OF FRAMING SQUARE.

⑥



LAY OFF BACK OF TEETH ON BOTH SIDES.

⑦



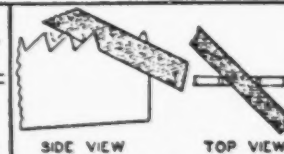
REMOVE $\frac{3}{4}$ OF METAL BETWEEN MARKS FILING FROM ONE SIDE.

⑧



SIDE VIEW TOP VIEW
1. PLACE SAW IN VISE WITH POINT TO LEFT.
2. PLACE FILE IN FIRST GULLET FROM LEFT.
3. SWING FILE HANDLE 45° TO LEFT.
4. FILE EVERY OTHER TOOTH TO POINT AT TOP LINE.

⑨

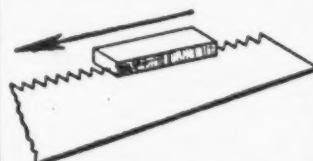


SIDE VIEW TOP VIEW
1. REVERSE SAW IN VISE POINT TO RIGHT.
2. PLACE FILE IN SECOND GULLET FROM RIGHT END.
3. SWING FILE HANDLE 45° TO RIGHT.
4. FILE EVERY OTHER TOOTH TO POINT AT TOP LINE.

⑩

RETOUCH WITH LIGHT STROKES TO PRODUCE KEENNESS.

⑪



REMOVE WIRE EDGE BY MAKING LIGHT STROKES WITH AN OILSTONE OR MILLFILE TOWARD HANDLE OF SAW.

⑫

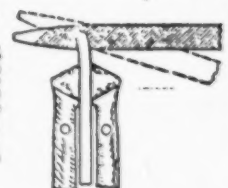


A FILE CUTS IN ONE DIRECTION ONLY—FORWARD.

⑬

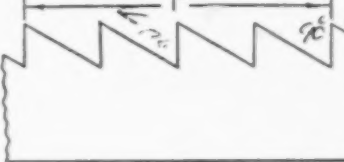
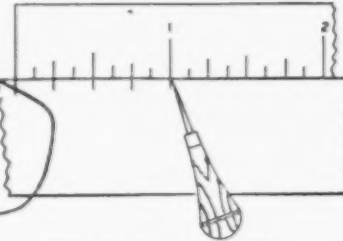
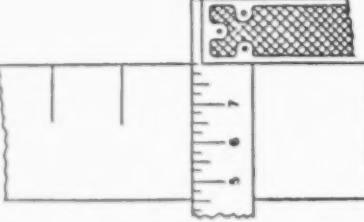
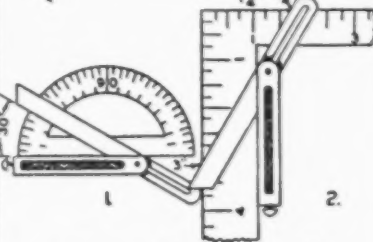
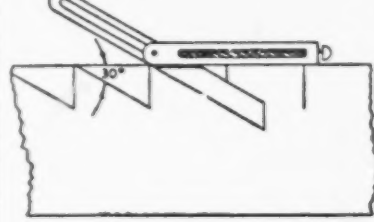
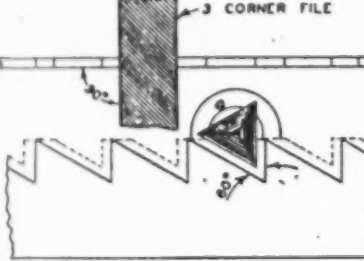
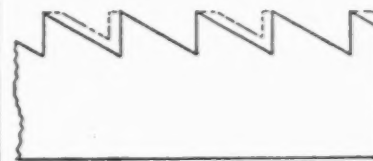
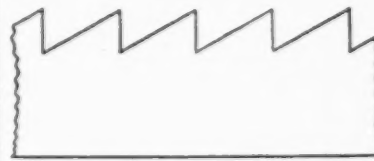
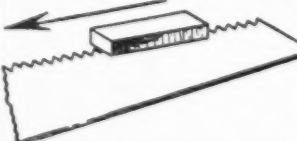
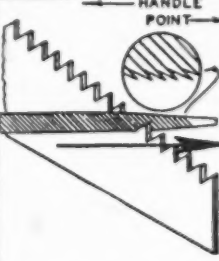
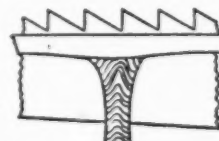
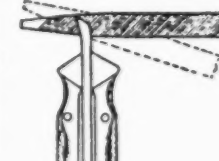
SUGGESTIONS

TO PREVENT SCREECHING, CLAMP BLADE IN VISE JAWS AS CLOSE TO BASE OF TEETH AS POSSIBLE.



IF NECESSARY DROP FILE HANDLE SLIGHTLY.

CUTTING RIP SAW TEETH

WHEN HANDSAW TEETH HAVE BEEN BROKEN OFF GRIND DOWN TO BASE OF TEETH AND CUT NEW TEETH. SUGGESTION: — BEFORE WORKING ON A GOOD SAW PRACTICE ON AN OLD SAW BLADE OR PIECE OF 12 GAUGE SHEET METAL. ①	5 POINTS PER INCH 4 TEETH PER INCH  SELECT NUMBER OF POINTS PER INCH WANTED. ②	 SPACE THE TEETH ACCURATELY. ③	
 LAY OFF FRONT OF TEETH ON BOTH SIDES. ④	 SET T-BEVEL FOR 30° 1 BY USE OF PROTRACTOR 2. BY USE OF FRAMING SQUARE. ⑤	 LAY OFF BACK OF TEETH ON BOTH SIDES. ⑥	
 REMOVE $\frac{3}{4}$ OF METAL BETWEEN MARKS FILING FROM ONE SIDE. ⑦	 REMOVE ACCURATELY REMAINDER OF METAL FROM EVERY OTHER GULLET FILING FROM ONE SIDE. ⑧	 REVERSE BLADE IN VISE AND REMOVE REMAINING METAL. BRING TEETH TO SHARP POINT AT TOP LINE. ⑨	
RETOUCH WITH LIGHT STROKES TO PRODUCE KEENNESS. ⑩	 REMOVE WIRE EDGE BY MAKING LIGHT STROKES WITH AN OILSTONE OR MILLFILE TOWARD HANDLE OF SAW. ⑪	SUGGESTIONS  A FILE CUTS IN ONE DIRECTION ONLY—FORWARD. ⑫  TO PREVENT SCREECHING, CLAMP BLADE IN VISE JAWS AS CLOSE TO BASE OF TEETH AS POSSIBLE.  IF NECESSARY DROP FILE HANDLE SLIGHTLY.	

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 6: How Do You Take Care of Hand Tools?

Estimated Time Required: One or two periods

Need For Lesson:

The proper attitude about tool care is very important to most employers. Students need to develop knowledge and attitudes that will allow them to care for tools properly. Hand tools are a major investment so they must be cared for properly.

Objectives:

Upon completion of this lesson, students should be able to:

1. Discuss the proper care of hand tools.
2. Fit a hammer handle.
3. Choose the correct coated abrasive for a specific job.
4. Refit a screwdriver.

Motivation:

If possible, collect several examples of badly mishandled tools. Have the class point out some things that would have kept the tools in the proper condition.

Presentation:

Discuss proper tool care with the class. Construct a list on the blackboard of suggestions concerning tool care. Construct another list of suggestions concerning tool storage. If you have a student who is from a situation where tools are properly cared for, you might want to ask questions about how tool storage and handling is being done by that student and have the class construct an ideal situation for that student's situation. Coated abrasives, hammer handle fitting, and screwdriver refitting are included in this lesson, but the instructor may elect to include them elsewhere.

Some Tool Care Items:

1. Auger bits can be cleaned up with oil and a piece of rope.
2. Tool handles will last longer if treated with a preservative such as linseed oil.
3. A thin coating of oil may sometimes be applied to prevent rust.
4. Always repair damaged tools before storing them.

5. Always use the correct tool for the job.
6. Buy quality tools.
7. Don't force tools.
8. If a tool is dull, sharpen it before proceeding.
9. A wire brush on a power grinder is handy for cleaning tools.
10. Always clean tools before storing them.
11. Repair damaged tool handles before use.
12. Sharp tools are safer than dull tools.
13. Don't hammer on tools unless they are designed for it.
14. Use care not to overheat cutting edges.

Some Tool Storage Items:

1. Tools should be kept dry.
2. Tools should be easy to find.
3. Tools should be secure from theft.
4. Files and tools with cutting edges should be protected from damage.
5. Tools should be kept clean.
6. Tools should be stored as near as practical to where they are normally used.
7. Tools should be stored when not in use.

Refitting a Screwdriver

Steps

Key Points

- | | |
|--------------------------|--|
| 1. Straighten the blade. | 1.1 If the blade is bent, straighten in on an anvil with a ball peen hammer. |
| 2. Joint the tip. | 2.1 Grind the end of the tip square.
2.2 Grind until all chips are removed. |

- 2.3 After jointing, the end of the tip should be slightly thicker than the screwslot.
- 2.4 For trial screwslot, choose a screw whose headsize is equal to the width of the blade of the screwdriver.

SAFETY NOTE: YOU MUST HAVE YOUR SAFETY GLASSES ON!!!

- 3. Grind the sides of the blade.
 - 3.1 Grind the sides of the blade until the tip is the correct thickness.
 - 3.2 The sides should be parallel for 1/4 inch from the tip.
 - 3.3 Do not grind a longer bevel than necessary, this weakens the screwdriver.

NOTE: Cool the tip frequently. Do not allow it to become hot.

- 4. Finish tip and face.
 - 4.1 Smooth the tip and face with an oilstone. Do not round the edges.

Fitting a Hammer Handle

Steps

Key Points

- 1. Remove the old handle.
 - 1.1 Place the hammer in a vise. Protect the hammer from the vise jaws with wood blocks or sheet metal.
 - 1.2 Saw off the broken handle with a hacksaw flush with the hammer head.
 - 1.3 Drive the old handle out of the head.
 - a. Drive toward the top of the hammer head.
 - b. It may be necessary to partially drill through the handle with a metal drill.
 - c. Save the metal wedge.
- 2. Select a handle for the hammer.
 - 2.1 The handle should be the proper size for the hammer.
 - 2.2 The handle should be straight grain.

3. Make the handle fit.
 - 2.3 There should be no knots in the handle.
 - 3.1 Clamp the handle in a vise. Use wood blocks for protection in a metal vise.
 - 3.2 Remove wood with a rasp and a file.
 - 3.3 Remove only enough wood so the handle fits tightly.
4. Cut a slot in the
 - 4.1 Make a single was kerf in the center of the handle.
 - 4.2 Make the derf $\frac{2}{3}$ to $\frac{3}{4}$ the depth of the eye of the handle.
 - 4.3 Use a rip saw.
 - 4.4 Some purchased handles already have the slot.
5. Install the handle.
 - 5.1 Place the handle on the head.
 - 5.2 Tap the end of the handle with a mallet until the handle protrudes $\frac{1}{8}$ " to $\frac{1}{4}$ " through the head. (OH-1)
6. Install the wedges.
 - 6.1 Start the wood edge into the slot.
 - 6.2 Pound the wedge in as tightly as possible.
 - 6.3 It may be necessary to drive a steel wedge diagonally across the wood wedge to make the handle fit snugly.
7. Trim the end.
 - 7.1 Saw the end of the handle flush with the hammer head with a hack saw.
8. Treat the handle.
 - 8.1 Saturate the handle with boiled linseed oil.
 - a. Keeps water out.
 - b. Keeps the handle and wedges tight.

Coated Abrasives

NOTE: This section on coated abrasives is included in this in this lesson for two reasons. Coated abrasives can be considered a hand tool, and coated abrasives are sometimes used when caring for hand tools.

Questions

1. What are coated abrasives?
2. What might we use coated abrasives for?
3. What types of abrasives are use?
4. What types of backing are used for coated abrasives?

Discussion

- 1.1 Coated abrasives are more commonly known as sandpaper.
- 2.1 Smoothing, removing paint or rust, cleaning, or polishing.
- 3.1 Natural abrasives
 - a. Flint--probably the most common abrasive used. Sandpaper is made with flint.
 - b. Garnet--a red semi-precious stone. Harder and tougher than flint.
 - c. Emery--used for polishing metal.
- 3.2 Artificial abrasives
 - a. Boron carbide--very hard Used in polishing or lapping.
 - b. Silicone carbide--very hard. Blue black in color. Widely used.
 - c. Aluminum oxide--reddish brown. Very tough. Widely used.
- 4.1 Paper--comes in four weights:
 - (A) Lightest, known as finishing paper. 40# per ream.
 - (C) and (D) Known as cabinet paper. 70# and 100# per ream respectively.
 - (E) Used for heavy production work 130# per ream.
- 4.2 Cloth--two main types.
 - (J) Jeans--lightweight but strong, used to sand irregular surfaces.
 - (X) Drills--medium weight. Flexible, used for belts and disks to sand flat surfaces.
- 4.3 Fiber--made from rag stock paper, used for disk and drum sanding material.

- | | |
|--|---|
| | paper, used for disk and drum sanding material. |
| | 4.4 Combination--lamination of paper and cloth, used for heavy duty jobs. |
| 5. How is the abrasive attached to the backing? | 5.1 Cattle hide glue--used when moisture isn't a problem. |
| | 5.2 Synthetic resin--used for making waterproof coated abrasives. |
| 6. What would some advantages of using water while sanding? | 6.1 Keep the paper clean. |
| | 6.2 Water acts as a lubricant. |
| | 6.3 Water controls dust. |
| | 6.4 Water keeps the paper cool. |
| 7. What are the methods of coating abrasives? | 7.1 Electrostatic |
| | 7.2 Gravity |
| 8. How is grit size measured? | 8.1 Aught (old system) the higher the number, the finer the grit.(5/0 is finer than 1/0) |
| | 8.2 Mesh (new method)the number of holes per square inch in a wire mesh screen. Higher numbers mean finer grit. |
| 9. What should you consider when purchasing and storing abrasives? | 9.1 The size of the grit |
| | 9.2 The type and method of coating |
| | 9.3 The kind of grit |
| | 9.4 The type of backing |
| | 9.5 The size of roll, sheet, or belt. |

Tryout:

1. Students will fit a hammer handle.
2. Students will refit a screwdriver.
3. Students will discuss tool care and storage. An assignment could be given in which the students discuss their own methods of tool care and storage.

Followup:

1. Handle fitting will be graded.
2. Screwdriver fitting will be graded.

Materials:

1. Various examples of coated abrasives.
2. Screwdrivers to be refitted.
3. Grinder with a medium to fine stone.
4. Container of water for cooling.
5. Screw heads for checking screwdrivers.
6. Oil stone, rags and oil.
7. Hacksaw
8. Safety glasses.
9. Hammer and punch.
10. Hammer heads and handles.
11. Drill and metal bits.
12. Rip saw.
13. Files and rasps.
14. Wedges
15. Boiled linseed oil.

References:

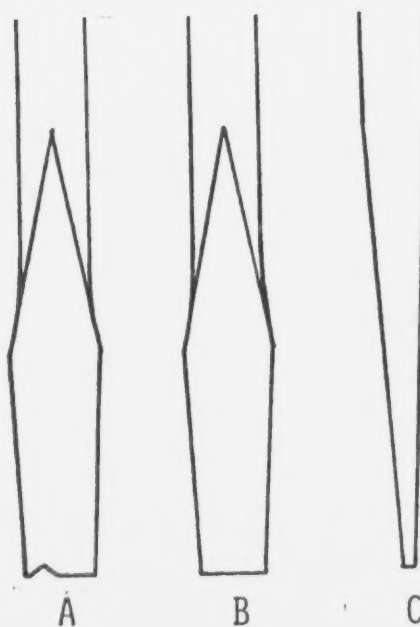
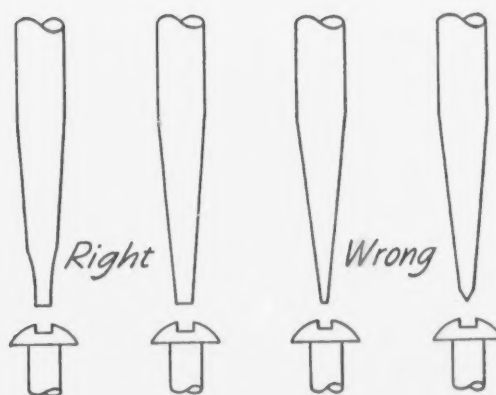
Sodergerg, George A., Finishing Technology, McKnight and
McKnight Publishing Co., 1969, pp.133-138

Resource Unit on Tool Use, (1976), pp.22,23,17.

Phipps, Mechanics in Agriculture, pp. 142-154.

Jones, Shopwork on the Farm, pp. 232-233,250-257.

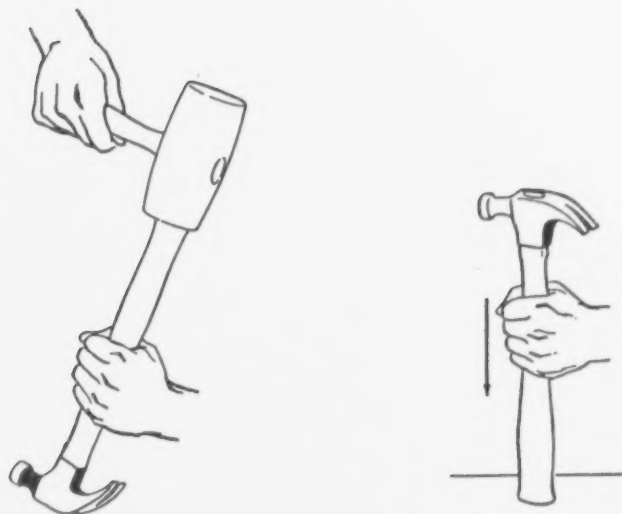
FITTING SCREWDRIVERS



A = NICKED SCREWDRIVER

B & C = PROPERLY RECONDITIONED SCREWDRIVER

TIGHTEN A HAMMER HANDLE



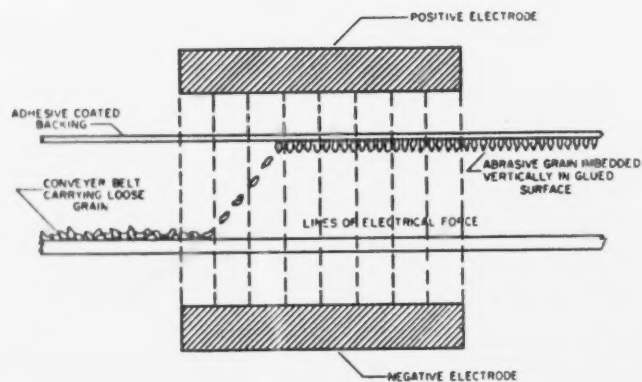
BE CAREFUL. EXCESSIVE FORCE MAY DAMAGE
OR SPLIT THE HANDLE

COATED ABRASIVES

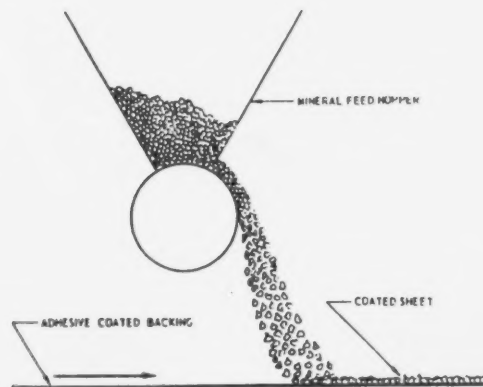
	Silicon Carbide	Aluminum Oxide	Garnet	Flint	Emery
Very Fine	600	600-12/0	-	-	-
	500	500-11/0	-	-	-
	400	400-10/0	-	-	-
	360	-	-	-	-
	320	320-9/0	-	-	-
	280	280-8/0	280-8/0	-	-
	240	240-7/0	240-7/0	-	-
	220	220-6/0	220-6/0	V. Fine	-
Fine	180	180-5/0	180-5/0	-	-
	150	150-4/0	150-4/0	-	Fine
	120	120-3/0	120-3/0	Fine	-
Medium	100	100-2/0	100-2/0	-	Medium
	80	80-1/0	80-1/0	Medium	-
	60	60-1/2	60-1/2	-	Coarse
Coarse	50	50-1	50-1	Coarse	-
	40	40-1½	40-1½	-	-
Very Coarse	36	36-2	36-2	V. Coarse	V. Coarse
	30	30-2½	30-2½	-	-
	24	24-3	24-3	-	-
	20	20-3½	20-3½	-	-
	16	16-4	-	-	-
	12	12-4½	-	-	-

USE THE RIGHT GRIT FOR THE JOB THAT YOU ARE DOING

TWO METHODS OF COATING ABRASIVES



COATING ABRASIVES USING THE ELECTROSTATIC PROCESS



COATING ABRASIVES USING THE GRAVITY FEED PROCESS

Unit: The Use of Hand Tools in Agricultural Mechanics

Lesson 7: Can You Use a Chainsaw Safely?

Estimated Time Required: Two periods

Need For Lesson:

Many students today are using chainsaws. If a number of students in a class are using chainsaws, perhaps it is the responsibility of the instructor to ensure that those students who are using or will be using chainsaws know how to use and maintain those saws. Since many students are too small to use a chainsaw safely, the instructor may want to approach the lesson with an emphasis on safety and parental supervision. This lesson can be taught at different times during the curriculum. Some instructors use chainsaws to introduce their small engines class.

Objectives:

Upon completion of this lesson the student should be able to:

1. Identify and explain the use of the parts of a chainsaw.
2. Identify safe chainsaw practices.
3. Describe safe methods of bucking, felling, and limbing.
4. Perform common maintenance procedures on a chainsaw.
5. Sharpen a chainsaw.

NOTE: If this lesson is taught at a lower level, the instructor may want to use only part of this lesson.

Motivation:

If possible, get the students into the lab or outside and make a few demonstration cuts with a chainsaw. Discuss the techniques you are using with the students and quiz the students about their perceptions of the safe use of a chainsaw.

Presentation:

Part 1: General Maintenance

The instructor may want to provide the students with a list of chainsaw parts. Using a chainsaw as a visual aid, go over the parts on the list and discuss their uses with the student.

Questions

1. How is the engine lubricated on most chainsaws?
2. How much oil do you use, & what type of oil do you use?
3. What kind of gas should you use?
4. How is the cutting chain lubricated?
5. When might you need extra oil?
6. What type of oil should you use on the bar and chain?

Discussion

- 1.1 Oil in the gas--2 cycle
- 2.1 The amount of oil may range from 1 part oil to 16 parts gas to 1 part oil to 50 parts gas. Look in the operator's manual for the saw you are using.
- 2.2 Use special 2 cycle oil, regular motor oil may cause damaging deposits.
- 3.1 Use regular leaded gasoline unless your operator's manual tells you otherwise.
- 3.2 Be sure the fuel-oil mixture is well mixed.
- 3.3 Most chainsaws have a replaceable filter on the gas inlet line in the fuel tank.
- 4.1 Most chainsaws have automatic oilers that can be adjusted to provide the correct amount of lubrication to the chain.
- 4.2 As a general rule, the oil should last about as long as a tank of gas. Hold the chainsaw near a piece of freshcut wood with the chain moving fairly rapidly and look for oil spray to see if the oiler is working.
- 5.1 Extra oil may be required in abrasive wood or hard wood. Wet or snowy conditions may also require the use of extra oil.
- 6.1 Bar and chain oil is best. Some recommend 80 weight transmission oil cut with kerosene. Others recommend a nondetergent motor oil.

7. What parts on a chainsaw engine would require maintenance?

6.2 In cold weather, oil that is too thick can damage the automatic oiler.

7.1 Spark plug--Replace with the recommended plug only. Gap the plug to the recommended gap.

7.2 Air cleaners--some air cleaners can be washed in clean solvent, others can be washed in soap and water. A clean air cleaner is important.

7.3 Fuel tank and oil tank--should be flushed regularly. Put in a small amount of gas, shake the saw, and dump the gas.

SAFETY NOTE: EXTREME CARE SHOULD ALWAYS BE USED WHEN ADDING GAS OR OIL TO A CHAINSAW.

7.4 Gas filter--found in the fuel tank. Usually can be replaced.

7.5 Spark arrester--many public areas require the use of a spark arrester. It is a fine screen or other device that covers the exhaust port on the engine to prevent the release of sparks. It must be clean in order for the engine to run properly.

7.6 Cooling fins--keep the saw clean for proper cooling and to reduce fire hazard.

8. What parts in the

8.1 Chain brake--the chain brake is designed to stop the chain in the event of kickback. It should be tested frequently according to the manufacturer's instructions. If it fails to function properly, it must be repaired or adjusted.

8.2 Drive sprocket--should be replaced when a new chain is installed. Keep the drive sprocket clean and well lubricated.

- 8.3 Clutch and clutch drum--should be kept clean. If the clutch slips, it should be repaired or replaced.
9. What parts on the bar will require maintenance?
 - 9.1 Guide bar--should be turned frequently to insure even bar wear.
 - 9.2 Bar groove--should be cleaned every time the chain is removed.
 - 9.3 Oil passages--at the base of the bar. Should be cleaned every time the chain is removed.
 - 9.4 Burr on bar--after much use a wire edge will appear on the bar. It should be removed with a file periodically.
 - 9.5 Sprocket tip--should be replaced when a new chain is installed if it is the replaceable type. The tip does not need lubrication for periodic use, but should be lubricated during hard use or under adverse conditions. The sprocket tip can be lubricated in several ways.
 - a. Needle nose grease gun with #1 GP grease.
 - b. Oil can.
 - c. Oil soak with SAE 10 or 30 motor oil.
10. What should you know about chainsaw chains?
 - 10.1 Pitch--the distance between rivet centers. 1/4", .325", 3/8", and .404" are the common sizes.
 - 10.2 Gauge--thickness of the drive link tang. The tang must match the bar.

Homelite and Stihl:
 0.50"--3/8 pitch
 0.63"--.404 pitch
 McCulloch--0.58"
 Scandinavian saws--0.58"

- 10.3 Tooth type:
 - a. Chipper--rounded corner
 - b. Chisel--square cornerThe chisel tooth is more aggressive than the chipper tooth so an amateur may use the chisel tooth.
- 11. How do you sharpen a chainsaw?
 - 11.1 Determine the size file that fits your saw. Common file sizes are 3/16", 7/32", and 1/4".
 - 11.2 A chain should be touched up frequently by hand and sharpened occasionally by machine to insure that the correct angles are maintained.
 - 11.3 To handsharpen:
 - a. Choose the proper file.
 - b. Hold the file with 1/7th of the file above the top plate edge.
 - c. Don't file too low(hook) or too high(backslope).
 - d. Always file toward the outside of the chain.
 - e. Sharpen all teeth on one side, then reverse and sharpen all teeth on the other side. Use the same number of strokes and the same amount of pressure on each tooth.
 - f. Use a depth gauge and flat file to set the gauges. Too high--the saw won't cut; too low--the saw tries to cut too much.

NOTE: Many types of power sharpening tools and hand filing guides are available. The instructor may want to include some of these devices in this lesson.

Part 2: Safe Cutting Techniques

The tape "Safe Cutting With Your Chainsaw" listed in the references for this lesson would be an excellent way to begin this section.

Questions

1. What are the three types of cutting that you would normally do?
2. What should you know about felling timber?

Discussion

- 1.1 Felling--cutting a standing tree.
- 1.2 Limbing--removing limbs from a downed tree.
- 1.3 Bucking--cutting logs into lengths
- 2.1 The main point in felling timber is to make the tree fall where you want it to fall safely.
- 2.2 To fell a tree properly a hinge must be created.
 - a. Make the first cut on the side toward where you want the tree to fall horizontally about $\frac{1}{3}$ the diameter of the tree.
 - b. Make a notch by starting a second cut at a 45 degree angle above the first.
 - c. Make the third cut from the opposite side of the tree horizontally about 2 inches above the first cut. Cut approximately $\frac{2}{3}$ the diameter of the tree. This will form a hinge to guide the tree as it falls.

SAFETY NOTES:

1. WATCH OUT FOR "WIDOW MAKERS" (LOOSE OVERHEAD BRANCHES THAT MAY FALL)
 2. PREPARE A SAFE LINE OF RETREAT AT A 45 DEGREE ANGLE TO THE FALL LINE OF THE TREE.
 3. WORK IN A CLEAR AREA.
-
3. How do you limb safely?
 - 3.1 Keep the work area clear.
 - 3.2 Don't over-reach.
 - 3.3 Watch for "spring poles" (limbs that will spring up when weight is removed)
 - 3.4 Don't stand on the log.
 - 3.5 Remove supporting limbs last.

4.2 Situations:

- a. Log supported the entire length-- cut from the top about $\frac{2}{3}$ of the diameter, roll the log over and finish the cut. Use care to stay out of the dirt.
- b. Log supported on one end --first cut from the bottom about $\frac{1}{3}$ the diameter.(underbuck) Finish the cut by overbucking to avoid pinching the bar.
- c. Log supported on both ends. Overbuck about $\frac{1}{3}$ the diameter, then finish the cut by underbucking to avoid pinching the bar.

IMPORTANT NOTE: IF STUDENTS ARE ALLOWED TO USE CHAINSAWS, IT IS STRONGLY SUGGESTED THAT THEY PASS A VERY COMPREHENSIVE SAFETY TEST!!!!

Tryout:

1. Students will perform general maintenance procedures on chainsaws.
2. Students will hand sharpen a chainsaw chain.
3. (Optional) Students will demonstrate safe use of a chainsaw by demonstrating felling, bucking, and limbing procedures.

Followup:

1. Saw sharpening will be graded.
2. Saw maintenance excercises will be graded.
3. Material presented will be covered on quizzes and on the unit test.

1. Chainsaws to work on
2. Chainsaw files, depth gauges, and other sharpening tools
3. Chainsaw safety tip handouts
4. Chainsaw parts handouts
5. Wood for cutting demonstration
6. Chainsaw safety test if used

References:

"Safe Cutting With Your Chainsaw,(cassette tape), Beaird
Poulan Division of Emerson Electric Company.

Chainsaw Safety Manual, Andreas Stihl, Postfach 1760, D-7050
Waiblingen.

Sarna, R.P., Chain Saw Manual, The Interstate, Danville,
Illinois, 61832.

Chain Saw Safety, Gallatin National Forest, U.S. Department
of Agriculture.

Phipps, Mechanics in Agriculture, pp.132-134.

CHAIN SAW SAFETY TIPS

1. KNOW YOUR SAW--Read the owner's manual and all supplements.
2. KNOW YOUR LIMITATIONS--Do not attempt operations beyond your ability or experience.
3. WEAR THE PROPER CLOTHING--Clothing should be close fitting and appropriate for the weather conditions.
4. WEAR THE APPROPRIATE SAFETY GEAR--Hard hat, safety glasses, safety shoes, heavy duty work gloves, ear protection devices.
5. USE THE RECOMMENDED FUEL--Check your owner's manual for the fuel specifications.
6. USE CAUTION WHEN REFUELING:
 - a. Remove the fuel cap slowly.
 - b. Do not overfill or spill fuel.
 - c. Don't refuel a hot saw.
 - d. Refuel in a safe place away from combustible materials.
 - e. Don't start the saw within 10 feet of where it was refueled.
 - f. Don't smoke while refueling or operating the saw.
7. DON'T WORK ALONE.
8. START THE SAW WITHOUT HELP--Starting the saw on the ground is the safest method. Don't start a saw on your leg or knee
9. NEVER OPERATE A CHAINSAW WHEN YOU ARE TIRED.
10. BEWARE OF KICKBACK--Hold the saw firmly and watch where you cut.
 - KICKBACKS CAN BE CAUSED BY:
 - a. Striking limbs or metal.
 - b. Running the engine slowly.
 - c. Dull or loose chain.
 - d. Cutting above shoulder height.
 - e. Inattention while cutting.
11. INSPECT AND TEST THE CHAINBRAKE AND OTHER SAFETY DEVICES FREQUENTLY.
12. DON'T WORK IN ADVERSE WEATHER CONDITIONS.
13. AVOID WORKING OFF A LADDER.
14. PLAN THE CUT AND THE RETREAT AREA.
15. BE SURE OF YOUR FOOTING.
16. USE WEDGES TO HELP CONTROL FELLING.

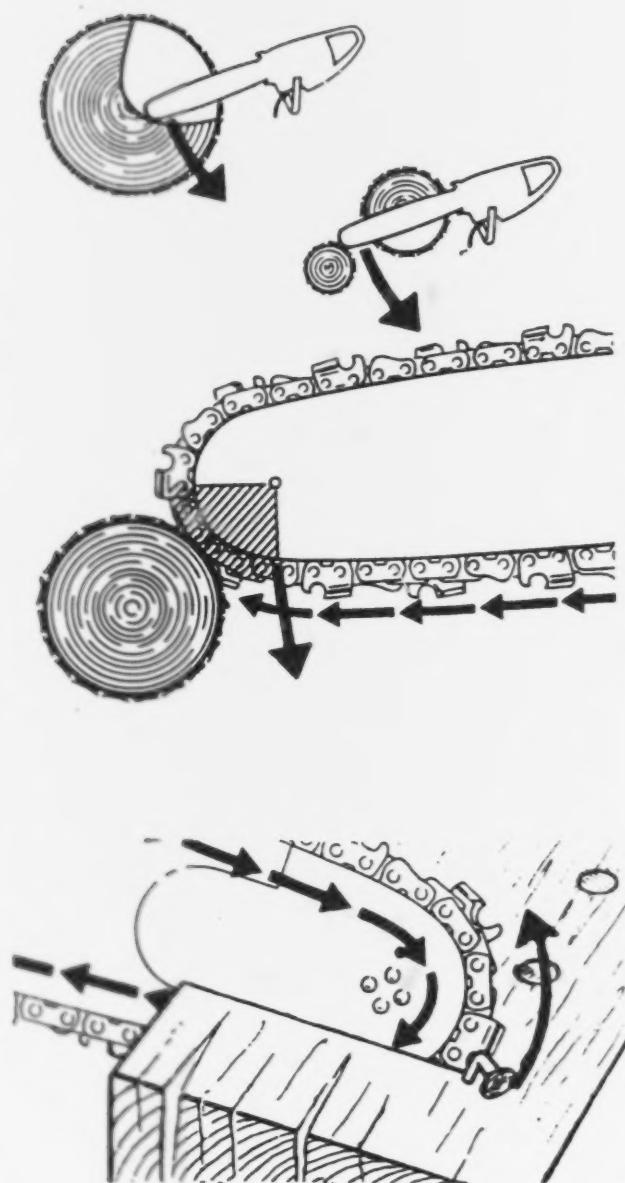
17. USE BOTH HANDS ON THE CHAINSAW.
18. DON'T CUT IN AWKWARD POSITIONS--Reaching, cutting above shoulder level, and cutting off balance are dangerous.
19. OPERATE THE SAW ONLY IN A WELL VENTILATED AREA.
20. USE A SPARK ARRESTER AND OTHER FIRE SAFETY DEVICES WHERE APPROPRIATE.
21. NEVER OPERATE YOUR CHAINSAW WITHOUT A MUFFLER.
22. DO NOT CARRY THE SAW BY THE CHAIN BRAKE LEVER.
23. AVOID CARRYING A RUNNING SAW.
24. DON'T TOUCH OR TRY TO STOP A MOVING CHAIN WITH YOUR HAND.
25. DON'T ALLOW ANY OTHER PERSON OR ANIMAL CLOSE WHILE CUTTING.
26. DON'T TOUCH THE MUFFLER OR OTHER HOT PARTS OF THE SAW.
27. DON'T OPERATE THE SAW IF THE CLUTCH IS NOT FUNCTIONING PROPERLY.
28. OBSERVE ALL LOCAL FIRE PREVENTION REGULATIONS.
29. USE A GUIDE BAR SCABBARD WHEN TRANSPORTING YOUR SAW.
30. KEEP THE CHAIN SHARP AND SNUG ON THE GUIDE BAR.
31. KEEP YOUR SAW CLEAN.
32. KEEP ALL BOLTS AND FASTENERS TIGHT.

PARTS OF THE CHAIN SAW

1. GUIDE BAR--Supports and guides the saw chain.
2. SAW CHAIN--A loop consisting of cutters, straps, and drive links.
3. FUEL TANK CAP--Vented to prevent a buildup of vacuum or pressure in the tank.
4. OILER BUTTON--Used to provide extra chain lube in certain situations.
5. THROTTLE TRIGGER--Used to control engine speed. Notice the safety throttle lock and throttle opening device used for starting.
6. REAR HANDLE--The support handle for the right hand. Notice the rear hand guard.
7. SPARK PLUG COVER--Insulates and protects the spark plug.
8. AIR CLEANER COVER KNOB--Allows access to the air cleaner.
9. FRONT HANDLE--Handle for the left hand at the front of the saw.
10. STARTER COVER--Covers the starter mechanism.
11. STARTER HANDLE--Used for starting the engine.
12. IGNITION/STOP SWITCH--Must be "ON" for the engine to run.
13. THROTTLE LATCH--Holds the throttle open for starting.
14. CARBURETOR CONTROLS--Used to adjust the carburetor.
15. CHOKE BUTTON--Used when starting a cold engine.
16. CHAINBRAKE LEVER/HANDGUARD--Used to keep the chain from turning or to stop the chain in the event of kickback.
17. OIL TANK CAP--Covers the chain oil tank.
18. SAW CHAIN ADJUSTMENT SCREW--Used to adjust chain tension.
19. CHAIN BREAK RETAINING NUTS--Provide access to the bar and chain.
20. CHAIN BREAK--Locks the chain.
21. MUFFLER--Lowers the sound level. Note the spark arrester.

- 22. FAN HOUSING W/FUEL SIGHT GAUGE--Knowing the fuel level is important when felling trees.
- 23. SAFETY TRIGGER--Must be held to open the throttle.
- 24. BOTTOM SHROUD (BOOT LOOP)--Hand protection and holding for starting.
- 25. DSP BUTTON--Compression release.
- 26. SPIKE--Useful when felling trees.

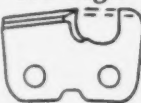
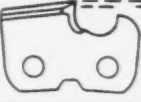
PREVENT CHAINSAW KICKBACK

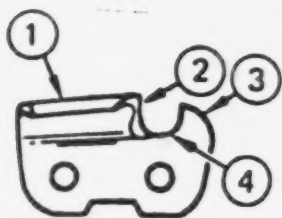


CHAIN SAW SHARPENING

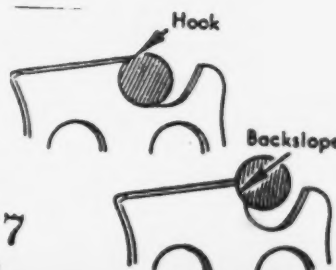
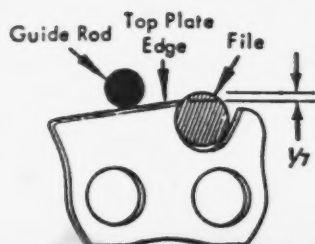
COMMON FILING ERRORS

All of these errors must be corrected by refiling.

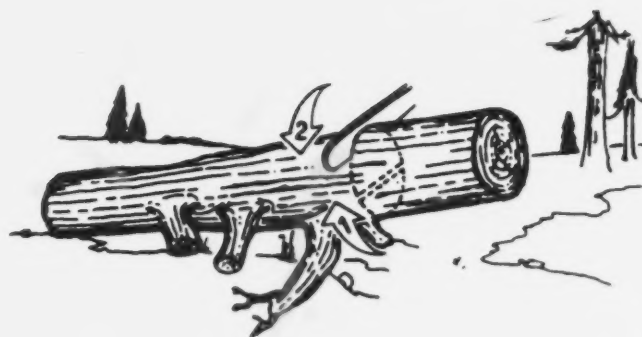
Cutter Fault	Cause	Result
Hook 	(a) File too small. (b) Handle held too high.	Dulls quickly and will not cut smoothly.
Backslope 	(a) File too large. (b) Handle held too low.	Cuts slowly and requires extra pressure.
Depth Gauges too high 	Not filed down.	Cuts slowly, requires extra pressure and leads to cutter damage.
Depth Gauges too low 	Too much filing.	Rough cutting, requires more power (cuts too deep).



1. TOP PLATE
2. SIDE PLATE
3. DEPTH GAUGE/GUARD
4. GULLET



SAFE BUCKING PROCEDURES



1ST WAY



2ND WAY

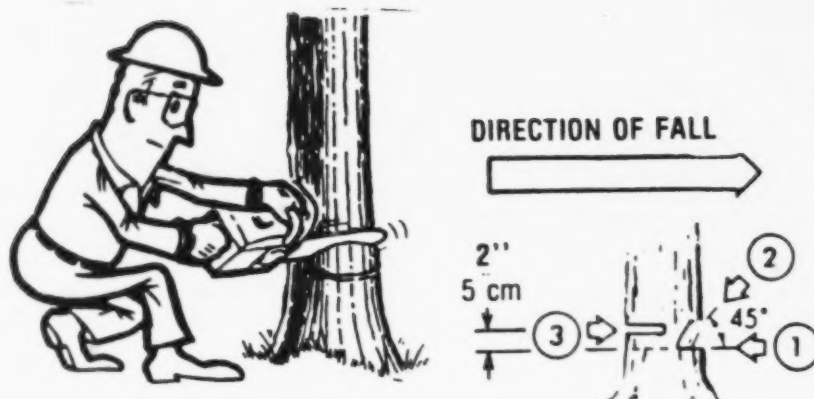


3RD WAY

CORRECT CLOTHING FOR USING
A CHAIN SAW



SAFE FELLING PROCEDURE



CHAIN SAW MAINTENANCE

ITEM	MAINTENANCE	FREQUENCY			
		DAILY	WEEKLY	MONTHLY	AS REQD
SCREWS, NUTS, BOLTS	INSPECT & TIGHTEN	●			
CONTROLS	INSPECT	●			
AIR FILTER	CLEAN	●			
	REPLACE		●		
SAWDUST GUARD	CLEAN	●			
CHAIN	INSPECT & SHARPEN	●			
BAR	CLEAN & TURN	●			
SHOCK MOUNTS	INSPECT	●			
	REPLACE*				●
SPROCKET	INSPECT	●			
	REPLACE				●
FUEL FILTER	REPLACE				●
OIL SCREEN	CLEAN		●		
MUFFLER	CLEAN			●	
MUFFLER SCREEN	CLEAN	●			
	INSPECT & REPLACE				●
SPARK PLUG	CLEAN & ADJUST		●		
	REPLACE				●
CYLINDER FINS	CLEAN		●		
STARTER ROPE	INSPECT		●		
	REPLACE*				●
CARBURETOR	CLEAN*			●	
FUEL TANK	CLEAN			●	
LAMINATION GAP	CLEAN & ADJUST*			●	
EXHAUST PORTS	CLEAN*			●	
FUEL, OIL & PRESSURE HOSES	CHECK*	●			●
CARBURETOR DIAPHRAGM	REPLACE ONCE A YEAR*				
CRANKSHAFT SEALS	REPLACE ONCE A YEAR*				
DSP VALVE	CLEAN			●	